CP-PC-1420E

azbil

Flame Safeguard System Selection Guide

Based on its core principle of *human-centered automation*,
Azbil Corporation offers combustion equipment
that provides safety and peace of mind.

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Flame Safeguard System

Overview

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- Ideas in Support of Industrial Furnace Safety
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Introduction to Flame Safeguard System

Flame Safeguard System

Basic structure of flame safeguard system

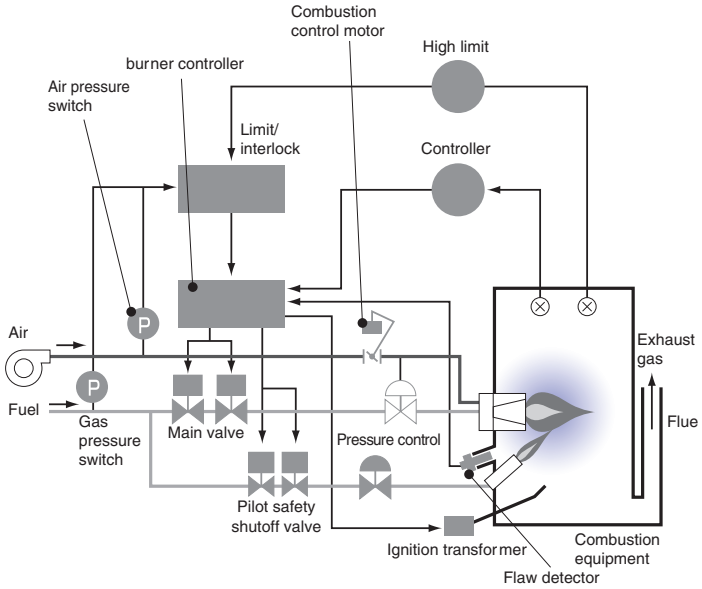
The flame safeguard system limits the operation to within safe operational ranges using limits and interlocks, and always monitors combustion conditions by means of a flame detector. The signal from the flame detector is converted by burner controller into the signal required for actuators to operate safety shutoff valves.
If some failure has occurred in the combustion equipment resulting in an ignition failure or other burner flame failure, the flame detector detects the abnormal condition of combustion flame, transmits the signal to the burner controller to close the safety shutoff valves, and prevents the flow of fuel into the combustion chamber.
If the flame detector or burner controller has caused a failure, the system has a safety circuit function to operate the fuel shutoff valves or not to start the burner.

Functions of the Flame Safeguard System

- Stops the burner by automatic or manual operation.
- Starts the burner in correct sequence and monitors the combustion flame during operation.
- Protects against abnormal temperatures or pressures.
- Controls the combustion quantity of the burner.
- Maintains the operation start standby state during burner stop.

FSG
(Flame Safeguard System)

The set of equipment used to provide safe control of burner operation. This usually includes the flame safeguard control, the flame detection system, all controllers, all limits and interlocks, all fuel valves, the ignition system, the firing rate control system, and any other auxiliary equipment.



The purpose of the FSG is to prevent an explosion.

**For this purpose,
the FSG does not allow fuel to accumulate in the furnace (combustion chamber).**

The FSG controls the fuel to keep the density below the explosion limit.

Cases of fuel accumulation in the furnace and corrective measures to them

Residual gas remains in furnace.	● Prepurge Ventilation must be made until fuel density is decreased to the level below the explosion limit. The ventilation time length must not be shortened even if a failure occurs. • Burner controller, safety shutoff valve (periodical maintenance)
Safety shutoff valve is opened before the ignition source is activated at the time of burner ignition.	● Correct ignition sequence Ignition must be made in the correct sequence. Operation will not occur if there is an abnormality. The sequence must not be changed even in the event of a failure. • Burner controller (start check, ignition sequence)
Burner is not ignited even though ignition operation is tried.	● Ignition timing Shutoff must be made before the density increases to the explosion limit. Ignition time length must not become longer even in the event of a failure. • Flame detector, burner controller (ignition sequence)
Burner has suddenly experienced a flame failure due to some cause during operation.	● Flame detection, reliable fuel shutoff, and flame response Flame failure must be reliably detected, and the fuel must be shut off before its density increases to the explosion limit. • Flame detector, burner controller (flame response), safety shutoff valve
Burner is experiencing incomplete combustion due to an inappropriate fuel/air ratio.	● Reliable limit and interlock Combustion conditions must be continuously secured by limits. • Gas pressure switch / air switch (periodical maintenance)

Introduction to Flame Safeguard System

Component Devices

Limit

1. Has the function of limiting operation so that it is within the safe operational ranges. Even when a control is out of order due to the malfunction of a controller, resulting in a continuing uncontrolled operational state, the limit controller can function to limit operation to within the safe ranges, ensuring safety. The limit controllers provided for safety must not be used mistakenly with other controllers. They must be clearly distinguished, selected and independently installed to ensure safety. The limit controllers are selected for reliable operation rather than for high accuracy.
   The extent to which combustion equipment can be controlled is dependent upon the safety provided by the limit controllers.

2. Responds to the temperatures, liquid levels and pressures. Industrial furnaces may have the problem of abnormally high temperature while boilers may have the problem of low water level or abnormally high pressure.

Interlock

1. Checks that the conditions are right to start combustion.

2. Checks that the conditions are right to continue combustion.

3. A start interlock is used to check the damper or burner position (high or low fire), fuel pressure, oil pre-heating temperature, and fuel shutoff valve closure.

4. A running interlock is used for fuel pressure, combustion air pressure, or draft.
   When the interlock for fuel pressure or combustion air pressure is operated, the safety shutoff is operated for lockout.

Flame detector

1. Detects the flame and sends a converted electric signal to the burner controller.

2. Flame detectors for industrial furnaces use the light (ultraviolet rays, etc.) emitted from the burner flame.

Burner controller

Burner controller has very important functions for the safety of burner operation and flame monitoring, and is designed as a failsafe system.

1. Detects that stable flame exists.

2. Starts the motor, fan, ignition and fuel valve in the correct sequence and at the correct time to ensure safe operation.
   (1) Supplies power to the devices in the correct sequence and at the correct time.
   (2) Shuts off the power supply given to the devices in a pre-determined sequence upon ignition failure, flame failure, or cessation of combustion.

3. Checks itself.
   (1) Checks its component parts every time an operation starts or power is applied.
   (2) Prevents burner ignition when a false flame signal exists.

4. Failsafe design is incorporated.
   (1) Failsafe design is incorporated in the start check circuit ensuring no occurrence of checking error.
   (2) Ignition sequence is never performed out of order.
   (3) There is no occurrence of a timing error that would result in a dangerous instruction. For example, the required period for prepurging gas from the furnace before ignition does not become shorter. The ignition spark timing does not become longer.

Safety shutoff valve

1. There are ON/OFF, high/low and proportional types.

2. Delayed operation is available for oil, and slow-opening operation is available for gas.

Temperature and Pressure Controllers

1. Operates to keep the control at a set point.

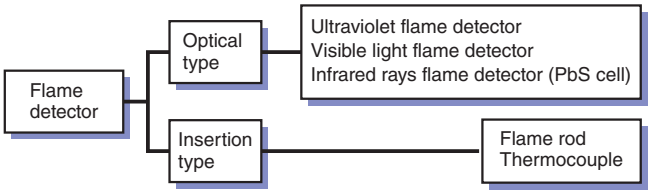
2. Includes the temperature controllers, and pressure controllers or start/stop switches.

Introduction to Flame Safeguard System

Detection of Combustion Flame

In the Flame Safeguard System, the detection of combustion flame has a very important role. The accurate detection of a flame is accomplished by fully utilizing the physical properties of flame.

●Types of flame detectors



The detection methods of combustion flames are categorized into two types:optical and insertion.
The optical type consists of a sensor element that indirectly detects the brightness in the furnace and flame color or its wavelength, and the electronic circuits for signal conversion and amplifier. Since the detection is indirect, care must be taken so as not to receive any influence of external light.
Since the insertion type is used by directly inserting the sensor element into the flame, the flame temperature, length, and state can be detected, and therefore the detection is highly reliable. However, care must be taken with regard to sensor responsiveness and mounting position.

●Selection of a flame detector

For the detection of a combustion flame, a flame detector that effectively utilizes the nature of the flame is necessary. When utilizing any flame detector, it is essential to select a detector which is appropriate for the nature of the flame.

• Ultraviolet flame detector

Since there are few restrictions in its mounting location, this detector is widely used for various applications. Care must be taken in its use so as not to mistakenly detect the spark of an igniter.
In the case of a continuously operating burner in which the flame does not stop for more than 24 hours, the use of a continuously self-checking type of flame detector is required to ensure failsafe operation.

• Visible light flame detector

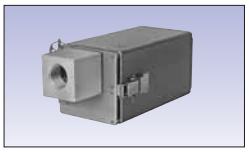
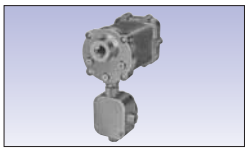
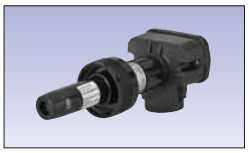
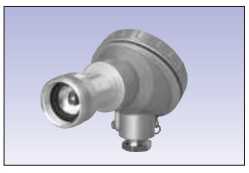
This detector is used for a compact oil-fired burner. The gas blue flame cannot be detected. When a boiler or agricultural drying furnace is installed outdoors, special care must be taken so as not to mistakenly detect sunlight.

• Flame rod

A flame rod utilizes the electrical conductivity of flame. In order to avoid a detection error in the event of a short-circuit between the sensor signal and the ground, the rectification function is utilized to ensure safety.

Introduction to Flame Safeguard System

Flame Detector Types and Features

Detectors	Model/appearance	Flame property	Applicable combustion	Main uses
Ultraviolet phototubes (UV sensors)	AUD300C1000 Series	Ultraviolet light 185–245 nm	Gas Oil	Batch operation or continuous operation Pilot burner monitoring Main burner monitoring Industrial furnaces Plants Boilers
	AUD500C11000 Series			
	C7076A 	Ultraviolet light 185–270 nm		[Reference] ●Continuous operation equipment means: Combustion continues for at least 24 hours ● Batch operation equipment means: Combustion starts and stops at least once every 24 hours Note: Flame detectors designed for continuous operation can also be used for batch operation.
	C7076D 			
	AUD100+AUD15	Ultraviolet light 185–245 nm		For batch operation Pilot burner monitoring Main burner monitoring Industrial furnaces Boilers
	AUD110+AUD15 			
Photo diodes (Visible light flame detectors)	AFD100	Light 400–800 nm	Oil	For batch operation Small oil-fired boilers
	AFD110 			

Introduction to Flame Safeguard System

Safety Shutoff Valves

●Safety technology related to safety shutoff valves

Source: Japan Gas Association, "Safety Technology Indices for Industrial Gas Combustion Equipment," January 2009

The basis of gas combustion equipment safety is the ability to shut off the gas supply immediately when an abnormal or dangerous state occurs. The safety shutoff valve is the key safety device for immediate shutoff of the gas supply to the overall equipment or to an independent zone when a hazardous state arises, such as a combustion issue like ignition failure or flame failure, or an abnormal rise in the temperature of the heating unit, or when the gas or air pressure falls outside the preset range. As a rule, two safety shutoff valves are installed in series in the event that one valve is not able to completely shut off the gas due some problem with the valve.

●Conditions requiring installation

Safety shutoff valves must be installed where they can immediately shut off the gas supply to the overall equipment or to an independent combustion zone when a hazardous state arises, with the exception of cases where the operator is able to continuously monitor the heating unit situation and immediately shut off the gas in the event of danger, such as when workmen are using hand-held acetylene torches near the gas pipeline.

●Safety shutoff valve

Safety shutoff valves must be able to shut completely and automatically within 1 second after the supply of electricity or air pressure stops, must be able to sufficiently withstand the usage pressure, and also must comply with the relevant standards.
Specifically, JIS B 8415 (General Safety Code for Industrial Combustion Furnaces) states that it is preferable for a fuel switch valve for a regenerative burner, such as a high-performance industrial furnace, that is being used as a shutoff valve to be given a minimum of two million operation test cycles as a durability test using the method prescribed in ISO 23550.

・Leakage Standards for Safety Shutoff Valves: List of Safety Shutoff Valve Leakage Standards

Standard	External leakage	Test methods	Internal leakage	Test methods
EN161 Europe	Standard bore DN < 10 20 cm^3/h or less 10 ≤ DN ≤ 25 40 cm^3/h or less 25 < DN ≤ 80 60 cm^3/h or less 80 < DN ≤ 150 60 cm^3/h or less 150 < DN 60 cm^3/h or less	Measure at the burette or water column gauge after applying 60 mm of H_2O and a pressure of 1.5 times the maximum usage pressure from the inlet and outlet.	Standard bore DN < 10 20 cm^3/h or less 10 ≤ DN ≤ 25 40 cm^3/h or less 25 < DN ≤ 80 60 cm^3/h or less 80 < DN ≤ 150 100 cm^3/h or less 150 < DN 150 cm^3/h or less	Measure at the burette or water column gauge after applying 60 mm of H_2O and a pressure of 1.5 times the maximum usage pressure from the inlet and outlet.
UL429 USA	200 cm^3/h or less	1.5 times the maximum usage pressure for those with 350 mm of H_2O or greater.	235 cm^3/h or less (when the internal diameter is greater than 11/2 B, add an extra 235 cm^3/h for each B)	• Test at 175 mm of H_2O and again at 1.5 times the maximum usage pressure (but at least 350 mm of H_2O). • Measure • Measure the pressure difference at a pressure gauge upstream from the valve.
JIS B 2151 Japan *1	30 cm^3/h or less	Measure with the leakage detector at 4.2 kPa as well as 0.5 kPa of air pressure from the inlet.	• 30 cm^3/h or less (for appliance valves) • 300 cm^3/h or less (for non-appliance valves)	Measure at the leakage detector at 4.2 kPa as well as 0.5 kPa air pressure from the inlet.
ISO 23551	Standard bore DN < 10 20 cm^3/h or less 10 ≤ DN ≤ 25 40 cm^3/h or less 25 < DN ≤ 80 60 cm^3/h or less 80 < DN ≤ 150 60 cm^3/h or less 150 < DN ≤ 250 60 cm^3/h or less	After carrying out an internal leakage test at 0.6 kPa, repeat the test using pressures of either 1.5 times the maximum usage pressure or 15 kPa, whichever is higher. However, those using gas at 11.2 kPa or 14.8 kPa should be tested at a minimum of 22 kPa.	Standard bore DN < 10 20 cm^3/h or less 10 ≤ DN ≤ 25 40 cm^3/h or less 25 < DN ≤ 80 60 cm^3/h or less 80 < DN ≤ 150 100 cm^3/h or less 150 < DN ≤ 250 150 cm^3/h or less	After carrying out an internal leakage test at 0.6 kPa, repeat the test using pressures of either 1.5 times the maximum usage pressure or 15 kPa, whichever is higher. However, those using gas at 11.2 kPa or 14.8 kPa should be tested at a minimum of 22 kPa.

*1. For cases of connection to a gas pipe with an outer diameter of 35 mm or less, for gas burning appliance automatic valves used in combustion equipment that uses city gas or liquefied petroleum gas at a gas pressure of 3.3 kPa or less.

・European Safety Shutoff Valve Standard (EN161 Group 2): Excerpted summary by Azbil Corp.

<table>
<tr><th>Item</th><th>Performance</th><th>Test methods</th></tr>
<tr><td>Leakage</td><td>
<table>
<tr><th>Size</th><th>External leakage</th><th>Internal leakage</th></tr>
<tr><td>DN < 10</td><td>20 cm^3/h or less</td><td>20 cm^3/h or less</td></tr>
<tr><td>10 ≤ DN ≤ 25</td><td>40 cm^3/h or less</td><td>40 cm^3/h or less</td></tr>
<tr><td>25 < DN ≤ 80</td><td>60 cm^3/h or less</td><td>60 cm^3/h or less</td></tr>
<tr><td>80 < DN ≤ 150</td><td>60 cm^3/h or less</td><td>100 cm^3/h or less</td></tr>
<tr><td>150 < DN</td><td>60 cm^3/h or less</td><td>150 cm^3/h or less</td></tr>
</table>
</td><td>Measure internal leakage after applying pressure from the inlet, and external leakage from the inlet and outlet, using 60 mm of H_2O and a pressure of 1.5 times the maximum usage pressure.</td></tr>
<tr><td>Valve closure ability</td><td>Must meet the above internal leakage standards when pressure is applied from the outlet.</td><td>Applied pressure
Class A: 1500 mm — H_2O
Class B: 500 mm — H_2O
Class C: 100 mm — H_2O</td></tr>
<tr><td>Durability</td><td>
<table>
<tr><th>Size</th><th>-15 °C</th><th>20 °C</th><th>60 °C</th><th>Total</th></tr>
<tr><td>1 or less</td><td>25,000 cycles</td><td>125,000 cycles</td><td>50,000 cycles</td><td>200,000 cycles</td></tr>
<tr><td>1¼–3</td><td>25,000 cycles</td><td>50,000 cycles</td><td>25,000 cycles</td><td>100,000 cycles</td></tr>
</table>
Must meet the operation, leakage, and valve closure pressures in the above test.
</td><td>Done with the pressure at the maximum allowable pressure, the flow rate at 10 % or less of the rating, the voltage at 85 % at –15 °C, 85 % and 110 % (half each) at 20 °C, and 110 % at 60 °C.</td></tr>
<tr><td>Flow</td><td>Must be within 95 % of specification.</td><td>Converted to 15 °C atmospheric pressure</td></tr>
<tr><td>Resistance to gas</td><td>With n-pentane must be within ±15 % of the volume change ratio.</td><td>Measure at 40 °C after steeping in 23 °C n-pentane for 72 hours and then air-drying for 72 hours.</td></tr>
<tr><td>Open time
(slow open)</td><td>Must be ±20 % of manufacturer's specification.</td><td>Measure the time taken to reach 80 % of the specification flow rate at 110 % of rated voltage at 60 °C and 85 % of rated voltage at -15 °C.</td></tr>
<tr><td>Strength
(torque: kgf·cm)</td><td>
<table>
<tr><th>Size</th><th>⅜</th><th>½</th><th>¾</th><th>1</th><th>1¼</th><th>1½</th><th>2</th><th>2½</th><th>3</th></tr>
<tr><td>Bending torque</td><td>7</td><td>10.5</td><td>22.5</td><td>34</td><td>47.5</td><td>61</td><td>110</td><td>160</td><td>240</td></tr>
<tr><td>Twisting torque</td><td>3.5</td><td>5</td><td>8.5</td><td>12.5</td><td>16</td><td>20</td><td>25</td><td>32.5</td><td>40</td></tr>
</table>
</td><td>For each, apply torque for 10 seconds and check for internal and external leakage.</td></tr>
</table>

Group division
Group 1: Shipped in the bracket, no force applied during piping work.
Group 2: Installed inside or outside the bracket, supported only by the pipe.

• Usage by class (following EN 746-2)

Combustion capacity	When monitored by operator	When not monitored by operator
Less than 120 kW (100,000 kcal/h)	Class A: 1 valve	Class B: 2 valves
Less than 120–600 kW (100,000–500,000 kcal/h)	Class A: 1 valve	Class A: 2 valves
Less than 600–1,200 kW (500,000–1,000,000 kcal/h)	Class B: 2 valves	Class A: 2 valves
1,200 kW (1,000,000 kcal/h) or above	Class A: 2 valves	Class A: 2 valves

● Closed position indicator switch

In ISO 23551-1 (Safety and control for gas burner and gas burning appliances – Particular requirements – Part 1: Automatic valves), the closed position indicator switch is defined as the switch attached to the valve that indicates that the closing part is in the closed position. The following are specifically required.

Structure

• Must not interfere with normal valve operation
• The adjustment mechanism must seal it so that it can be seen that no adjustments have been made that the manufacturer did not intend.
• No amount of drift in the adjustment switches or driving mechanism may interfere with normal valve operation.

Performance

The switch is required to indicate the closed position in both of the following situations.

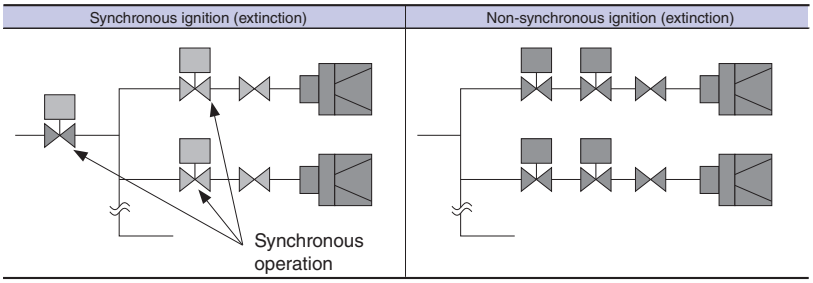
• When the flow is 10 % or less of the fully open flow at the same differential pressure.
• When the closing part is positioned within 1 mm of the closed position.

●Position during automatic ignition

Normally two safety shutoff valves should be installed separately in series on the fuel supply pipes for the pilot burner and the main burner.

During synchronous ignition or extinguishing, as shown below, the safety shutoff valves for each burner form one layer, and by adding another safety shutoff valve in the zone, it is possible to have a double valve structure. However, this does not allow ignition or extinction of one burner only.

• Pipe Layout for Double Shutoff Valves



In addition, for non-synchronous ignition and extinction, two safety shutoff valves need to be installed for each burner, using double shutoff. Unlike synchronous ignition, this configuration allows ignition and extinction of each burner separately.

Introduction to Flame Safeguard System

Gas Safety Shutoff Valve Flow Calculation

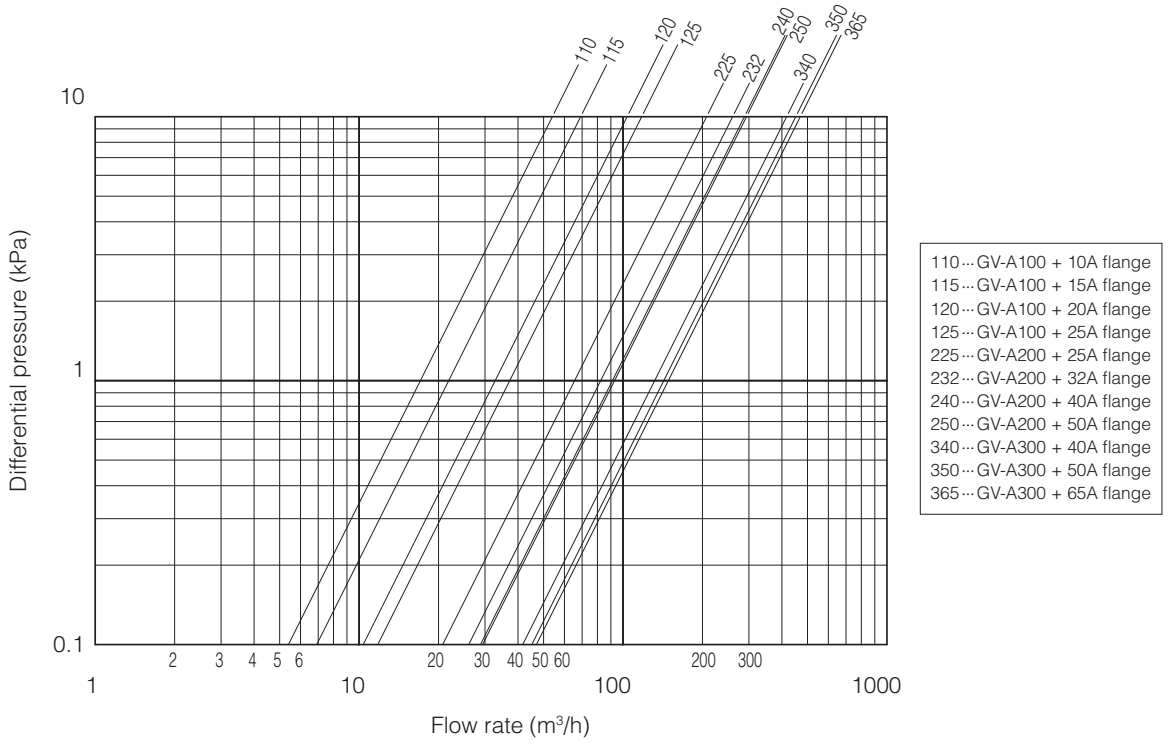
C_V is normally used as a coefficient for showing the valve flow-through rate (capacity), but safety shutoff valves often show the flow rate and C_V at a specific differential pressure or specific gravity determined by the gas.

Example:
The following table shows the C_V and flow rates for a GV-A high-performance industrial-use gas double electromagnetic valve (with two connected in series). The flow rate values are at 15 °C and 101.325 kPa.

Model	Connection bore	Flow rate m³/h differential pressure 250 Pa		C_V
		Specific gravity 0.65	Specific gravity 1.53	
GV-A100	10A (Rp 3/8)	8.5	5.6	5.8
	15A (Rp 1/2)	10.9	7.1	7.5
	20A (Rp 3/4)	16.4	10.7	11.2
	25A (Rp 1)	18.6	12.1	12.7
GV-A200	25A (Rp 1)	32.8	21.4	22.4
	32A (Rp 1 1/4)	41.1	26.8	28.1
	40A (Rp 1 1/2)	45.6	29.7	31.2
	50A (Rp 2)	46.4	30.3	31.7
GV-A300	40A (Rp 1 1/2)	65.9	43.0	45.0
	50A (Rp 2)	71.4	46.5	48.8
	65A (Rp 2 1/2)	74.3	48.4	50.8

C_V and flow rate can be read from this table only if the differential pressure is 250 Pa and the gas type is natural gas 13A (specific gravity: 0.65) or propane gas (specific gravity: 1.53).

The following graph shows the relationship between flow rate and differential pressure when natural gas 13A is flowing through a GV-A. The flow rate values are at 15 °C and 101.325 kPa.



This graph makes it possible to find the flow rate for any given differential pressure, for natural gas 13A only.

The preceding table had a limited range of differential pressures and gas types,
but it is possible to find the flow rate under other conditions by using the following calculation.

$$Q = K \times \sqrt{(\Delta P/\rho)} \cdots\cdots (1)$$

Q : Flow rate (m^3/h)
K : Proportional constant
ΔP : Differential pressure (Pa)
ρ : Specific gravity

A. When the differential pressure is 250 Pa or greater, use the following modification of formula (1) to find the flow rate:

$$Q=(\text{Flow rate table value}) \times \sqrt{((\text{defferential pressure})/250)}$$

Ex.: Find the flow rate for GV-A200 (bore: 1½), with a differential pressure of 980 Pa and natural gas 13A.
According to the above table, the flow rate is 34.7 m^3/h when the differential pressure is 250 Pa, so the flow rate is:
$Q=34.7\times\sqrt{(980/250)}=68.7\ m^3/h$

B. When the specific gravity is not 0.65, use the following modification of formula (1) to find the flow rate.

$$Q = (\text{Flow rate table value}) \times \sqrt{(0.65/(\text{specific gravity}))}$$

Ex.: Find the flow rate for GV-A200 (bore: 1½), with a differential pressure of 250 Pa and 6C gas (manufactured gas B).
If the specific gravity of 6C is 0.55, the flow rate is:
$Q=34.7\times\sqrt{(0.65/0.55)}=37.7\ m^3/h$

C. When the differential pressure ΔP ≠ 250 Pa and the specific gravity ρ ≠ 0.65, use the following modification of formula (1) to find the flow rate.

$$\text{Flow rate } Q = \text{Flow rate table value} \times \sqrt{((\text{defferential pressure})/250 \times 0.65/(\text{specific gravity})}$$

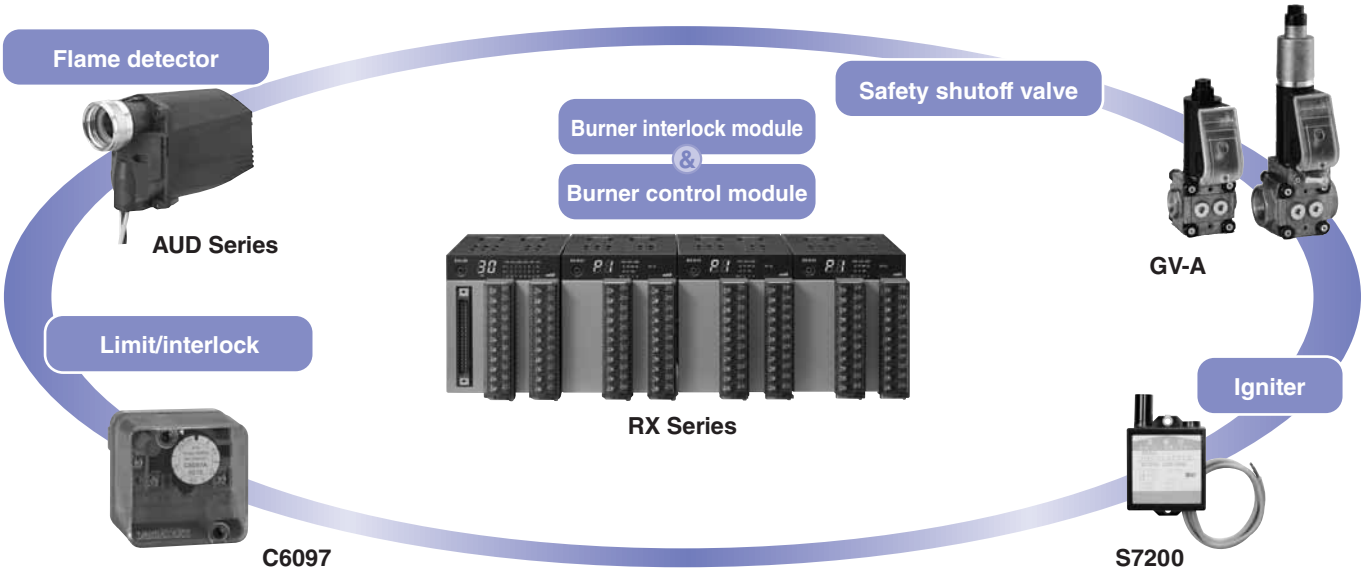
Ideas in Support of Industrial Furnace Safety

For a wide range of operation configurations and ignition methods, we provide total solutions, from flame safeguard control and flame monitoring to fuel shutoff, in support of safe combustion in industrial incinerators.

Flame safeguard controls Our new flame safeguard control system, consisting of burner interlock modules and burner control modules, uses a new architecture to allow safety, ease of use, and ease of adjustment when installing equipment and responding to problems.

Flame monitoring Our compact flame detectors for continuous operation combustion equipment can be used without problems even for burners having many restrictions, such as tight installation space or temperature requirements.

Fuel shutoff The advanced-function double-seated gas shutoff valve made by Elster Kromschroder, a company with a proven track record with European industrial burners, uses a modular structure that allows for installation in tight spaces around fuel pipes or burners when there are space or other restrictions.



For fuel-safe construction…

- Look for intrinsic safety
  - Carry out safety measures based on risk assessment
  - Mechanical safety/comprehensive safety indices (JIS B 9700-2/JIS B 9702)
- Separation of safety functions and control functions
  - Review software interlocks by means of control PLC
- Complexity of safety instrumentation circuits
  - Complexity increases due to redundancy and diagnostic circuits.

Burner interlock module & Burner control module

- Packaging of burner combustion control functions
  - Shortened design verification time for safety circuits
  - Reduced circuit design and verification for safety circuit construction
  - Selection and setting of pre-incorporated safety functions
  - Burner interlock module (interlock monitoring function)
- Packaging of panel safety instrumentation
  - Shortened wiring/installation/check times
  - Module connectors distribute safety signals and reduce wiring

For safety shutoff valve installation…

- Two valves installed in series
  - Installation space is often restricted
- Installation and replacement of shutoff valves
  - Removing surrounding piping is bothersome
- Compliance with international standards

Safety shutoff valve

- Saves space
  - Two can be installed in series to save space through modular construction
- Shortened time for installation and replacement
  - Can be easily installed or replaced by connecting the flanges
- Products meet European and international standards
  - EN 161/ISO 23551-1 (durability tests, valve closure switch display function)

For flame detector selection…

- Selection of devices suited to operation method
  - Self-checking flame detectors are used for continuous combustion of 24 hours or more
- Installation space restrictions
  - Numerous installation space restrictions around the burner Investigation is required for installation location and cooling measures around hot burners

AUD Series flame detector

- Self-checking flame sensor is designed for continuous operation
  - AUD300, AUD500 advanced UV sensors
- Installs in small spaces
- Withstands ambient temperatures up to 120 °C

General Safety Code for Industrial Combustion Furnaces: JIS B 8415: 2008

Outline of revisions to JIS B 8415 (November 2008)

Background

- **Safety methods through risk assessment created as ISO standard and introduced to Japan**
  - ISO 12100 (Basic concepts, general regulations for design)
  - JIS B 9700 (Basic concepts for safety and design of machinery)
  - Industrial Safety and Health Act Revision (Industrial Safety and Health Act)
- **Coordination with Western standards**
  European EN 746, USA NFPA 86
- **Standards supporting new technology**
  Support for high-function industrial furnaces (regenerative burners, etc.)

Position

- **JIS B 9700-1 Machinery Safety: Equipment regulations defined in basic concepts and general rules (Type C)**
  - Positioning in standards systems that also meet ISO standards

Scope

- **Heating equipment using gas or liquid fuel (industrial furnaces, etc.)**
  - Metallurgy, metal processing plants
  - Glass production, ceramics, cement production plants, etc.

Items \ Standard	JIS B 8415 (2008) General safety code for industrial combustion furnaces	Revised Japan Gas Association (2009) Safety technology indices for industrial gas combustion equipment	EN 746-2 (Europe) (1997) Industrial thermoprocessing equipment, Part 2. Safety requirements for combustion and fuel handling system	NFPA 86 (USA) (2007) Standard for Ovens and Furnaces
Control and operation circuits	Intrinsic safety design based on risk assessment (prohibition of software interlocks by general-use PLC)	Aiming for fail-safe and foolproof control and operation circuits (prohibition of construction of combustion safety interlocks using only general-use PLC)	Intrinsic safety design based on risk assessment (EN 292)	Design requirements to minimize fire and explosion risks requires use of PLC with safety protection equipment
Interlocks	Installed in series in holding circuit for safety shutoff valve	Must be directly connected to the main control terminals of the flame monitor relay or flame safeguard control system	Should immediately shut off for safety when interlocks operate.	Interlock setting values must be shown in writing Must be connected directly
Installation requirements for safety shutoff valves (for main burner, pilot burner)	Two installed in series (shutoff within 1 second)	Two installed in series (shutoff within 1 second)	Two installed in series	Two installed in series
Flame monitoring equipment for industrial furnaces that burn continuously for 24 or more hours *1	Self-check at least once a day	Self-check at least once a day	Continuous combustion operation uses a self-checking type or regular checks	Continuous combustion operation uses a self-checking type or regular checks
Individual monitoring of pilot and main burner flames	Individual monitoring	Individual monitoring	Individual monitoring	Individual monitoring
Flame failure response time in flame monitoring equipment	Within 4 seconds (Flame failure safety time: within 5 seconds)	Within 4 seconds *2 (shutoff within 5 seconds)	Within 3 seconds	Within 4 seconds
Installation of overheat protectors inside furnace	Must not make shared use of a temperature controller used for control or the controller's temperature detector.	Must not make shared use of a temperature controller used for control or the controller's temperature detector.	Must not make shared use of a temperature controller used for control or the controller's temperature detector.	Must not make shared use of a temperature controller used for control. Excess temperature limit interlock requires temperature display and manual reset.
False flame operation during start check	Safety shutoff and lockout	Check request at start	-	Check request at start
Pre-operation check of combustion air pressure	Combustion air detector must be checked when burner is started, and if there is an abnormality the burner must not be started.	Combustion air detector must be checked when burner is started, and if there is an abnormality the burner must not be started.	Combustion air detector must be checked when burner is started, and if there is an abnormality the burner must not be started.	-
Prepurge air flow (number of changes of air)	At least 5 times	At least 5 times	Completely 5 times	At least 4 times
Airflow rate at prepurge	At least 50 % of peak	At least 50 % of peak	At least 25 % of peak	At least 25 % of peak
Burner flame amount at ignition	Forced low fire ignition	Low fire ignition/extinction	-	-
Pilot burner ignition timing	Within 10 seconds	Within 10 seconds	Within 5 seconds: 70 kW or less Within 3 seconds: over 70 kW	Within 15 seconds
Main burner ignition timing	Within 5 seconds	Within 5 seconds	Within 5 seconds: 70 kW or less Within 3 seconds: over 70 kW	Within 15 seconds
Direct spark ignition (direct ignition)	350 kW or less	350 kW or less Under 58 kW → within 5 seconds Under 117 kW → within 3 seconds 350 kW or less → within 2 seconds	350 kW or less 70 kW or less: within 5 seconds 70 kW-350 kW: within 3 seconds	-
Installation of seismic detector equipment	Installed as necessary (for seismic intensity 6 or higher)	Installed as necessary (for seismic intensity 6 or higher)	-	-

*1. The flame monitoring equipment refers to a flame detector and a flame safety controller (burner controller). *2. If there are other regulations that specify the flame failure response time, they should be followed.

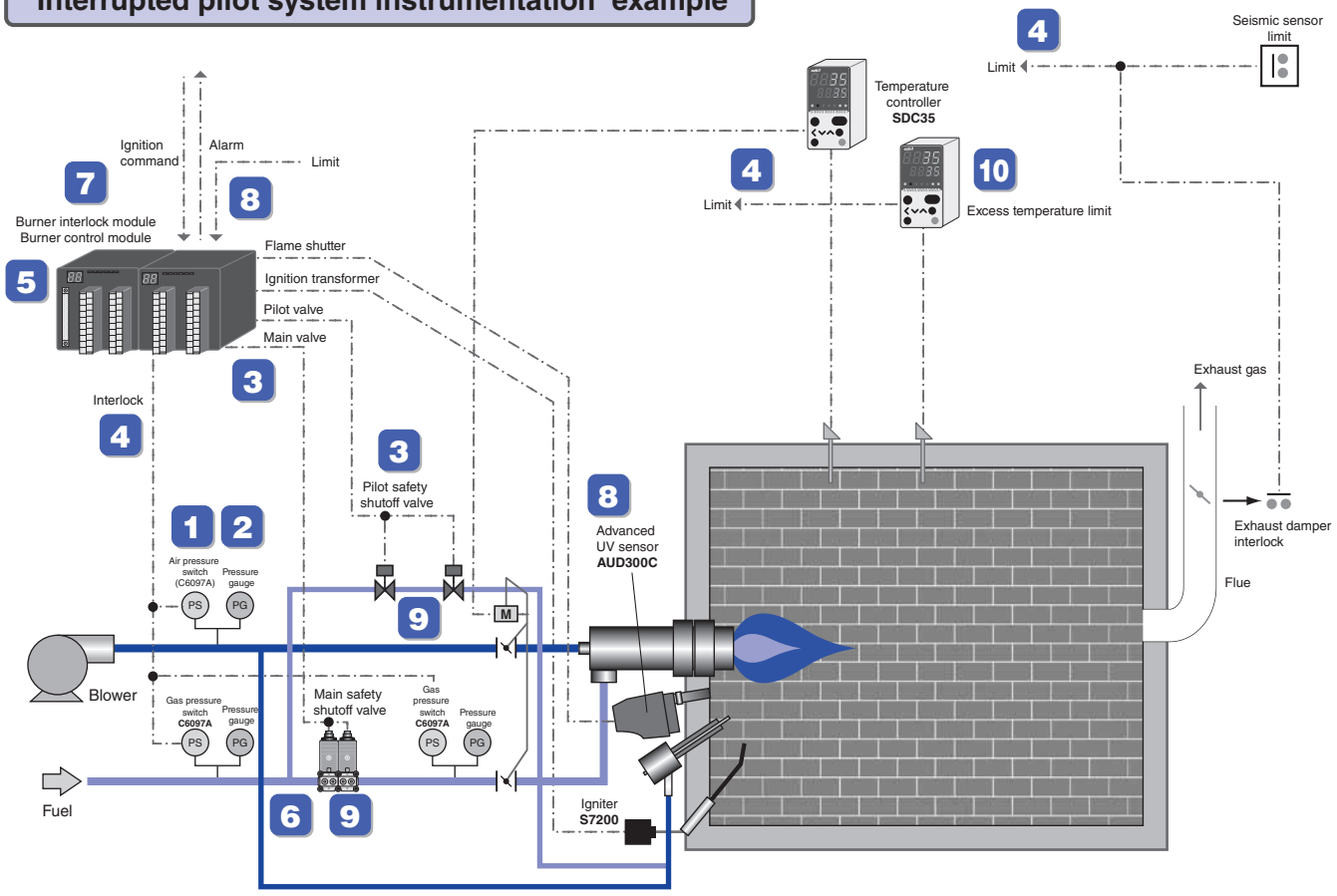
General Safety Code for Industrial Combustion Furnaces: JIS B 8415: 2008

Basic points for safe combustion

1. Proper purging (5 times furnace capacity)
2. The combustion air detector (air pressure switch) must be checked when the burner starts up, and if there is an abnormality, the burner must not be started.
3. The load on the fuel shutoff valve, etc. must be directly connected to the burner controller (the flame safeguard control system).
4. The limit/interlock is configured to directly cut off the power supply to the combustion shutoff valve load.
5. The start check circuit must operate properly at start-up.
6. There must be no manual operation or bypass circuit for any load.
7. Safety shutoff and lockouts for ignition failure and flame failure.
8. Correct selection of burner controller and flame detector. (Select a continuous operation burner controller or flame detector for equipment that is operated continuously for at least 24 hours.)
9. The main shutoff valve and pilot shutoff valve must both use double shutoffs.
10. An excess temperature limit interlock must be installed separately from the temperature controller for control use and the controller's temperature detector.
11. Individual monitoring of the pilot burner flame and the main burner flame
(For the continuous pilot method or the intermittent pilot method, separate flame monitoring equipment is required for the main burner.)

These items are also required by the European and American standards.

Interrupted pilot system instrumentation example

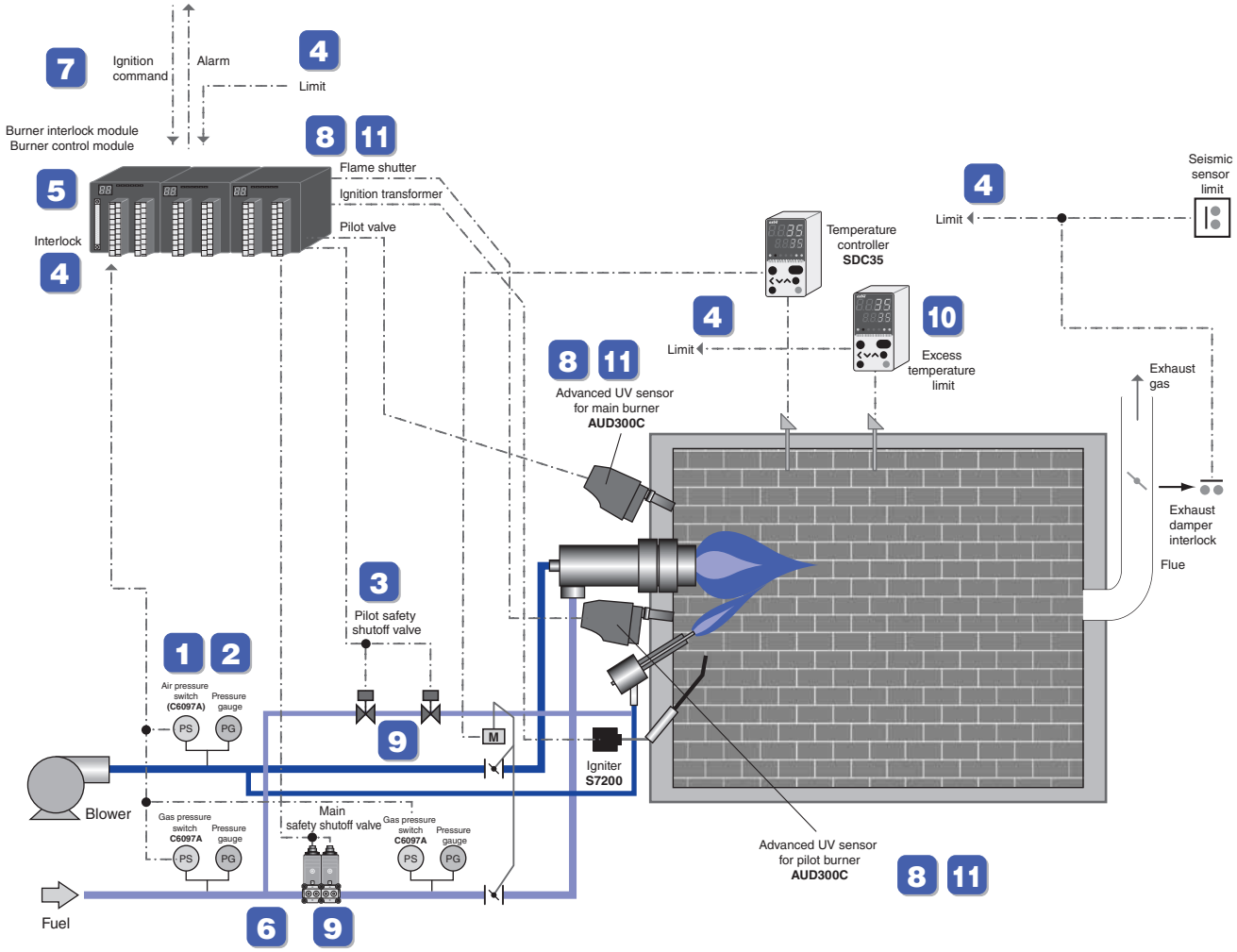


● Operation method for pilot and main burners

		Start-up ignition	Control extinction	Control ignition	Control extinction	Control ignition	Ignite
Continuous pilot	Pilot burner Main burner						
Intermittent pilot	Pilot burner Main burner						
Interrupted pilot	Pilot burner Main burner						

: Prepurge

Intermittent pilot system instrumentation example



Caution: **Precautions for burner control circuit design**

- Safety control and operation circuits must use an intrinsic safety design method based on risk assessment.
- Interlock (including limits) connections must be configured to directly cut off the load (ignition transformer, pilot safety shutoff valve, main safety shutoff valve, etc.).
- All shutoff contacts are to be on the ungrounded. In addition, leakage breakers, double-pole contacts and other anti-leakage measures are to be taken as necessary.
- The safety control circuit must promptly produce an alarm such as a light or buzzer as needed when an abnormal situation arises.

Precautions for instrumentation and circuit configuration for the intermittent pilot method

(1) The pilot burner and the main burner must have separate flame monitoring (flame detectors, burner controllers).
(2) The flame detector for the main burner must be installed where it will not detect the flame of the pilot burner.
(3) The limit and interlock must be connected to the limit and interlock terminals of the burner controllers for the pilot burner and the main burner so that they can directly shut off the load (ignition transformer, pilot shutoff valve, main safety shutoff valve, etc.).
(4) For the startup circuit configuration, the *main burner ignition enabled output (pilot flame ignition signal)* from the controller for the pilot burner must always be connected to the interlock input terminal and start-up input terminal on the controller for the main burner.
(5) When the pilot burner or main burner fails to ignite or goes out, the circuit must stop all burners.

Concept Behind Combustion Equipment Control and Safety

Even highly reliable control systems with high levels of performance and functionality cannot eliminate the risk of fire, since they can fail and become unable to control combustion. Unfortunately, improvements in controllability have not meant improvements in safety.

Normally, control and safety instrumentation are separated, so that even if the safety device is relatively inaccurate, one with reliable operation must be used. The relationship between safety and control must allow control to be performed where safety is assured, so the control zone must be an area that is included within the safe zone. This zone is where improvements in control must be made.

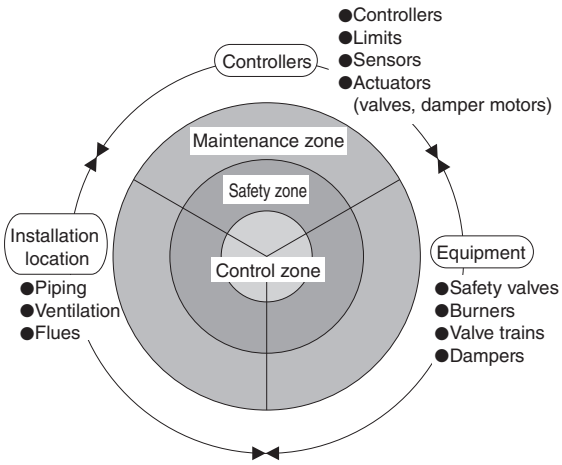
Control and safety tend to be thought of as being handled by control devices and safety devices, respectively. However, while this may usually be the case, they are difficult to achieve solely using these devices. The structure and function of the combustion equipment, facilities, etc., are also elements that affect control and safety.

In other words, achieving control and safety is possible only once the three elements of (1) control and safety devices, (2) equipment and facilities, and (3) the location (conditions of installation) are all appropriate. In addition, it is difficult to ensure safety in the case of all equipment or facilities failing or when the installation conditions are no longer met. When safety cannot be assured, we naturally wish to eliminate all failures and breakdowns, but even if all scenarios could be considered, it would still not be possible to absolutely guarantee safety.

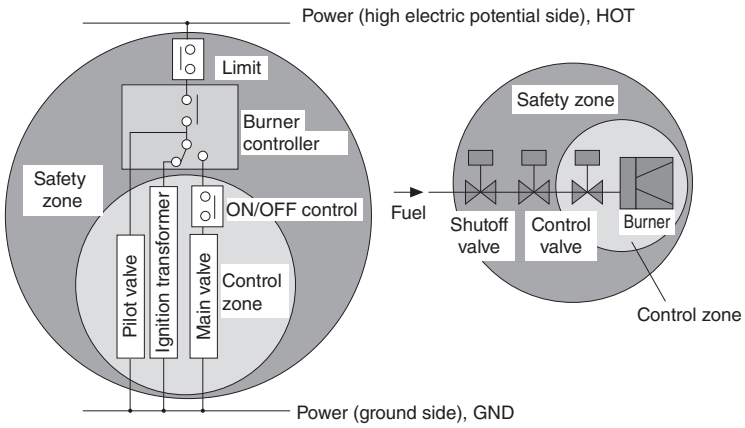
With this in mind, it is necessary to carry out regular inspections and maintenance of the equipment to ensure safety. That is, maintenance is also an important component of safety assurance.

In summary, combustion equipment and facilities are objects for control, but they also must be fundamentally safe. To achieve this, the control zone needs to be encircled by the safety zone, and that in turn must be encircled by the maintenance zone. The equipment and facilities, and the control devices (including the flame safeguard control system), and the installation conditions are each elements of control/safety/maintenance.

●Safety configuration of control system



●Specific example of safety configuration



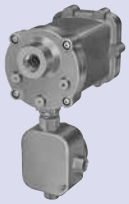
Memo

Product Line

Flame detectors

Continuous operation and intermittent operation systems

Advanced ultraviolet flame detector
AUD300 AUD500



Ultraviolet flame detector *1
C7076A C7076D

Intermittent operation systems

Advanced ultraviolet flame detector and socket
AUD100/110 + AUD15

Visible light frame detector
AFD100 AFD110

Flame detection signal

Limit / Interlock switches

Gas pressure switches

Gas pressure switch
C6097

Eathquake sensing switches

Earthquake sensing switch
V-725 VBC7000

Limit/ interlock signal

Burner controllers

Continuous operation and intermittent operation systems

Burner interlock module and
burner control module
RX-L and RX-R

Advanced UV relay
AUR350

Intermittent operation systems

Flame relay
FRS100

Protect relays

Protect relay
R4424 (for AFD100/110)
R4440 (for AFD100/110)

For detailed specifications, or to learn whether a product is available in a particular country, please contact our sales staff.

Dynamic self-checking burner controller
AUR450

MAX SAFETY multi protectoglo with UV tube diagnostic circuit
R4332B (for C7076)

Safety shutoff/ control

Valves / Actuators

Gas shut-off valves

Solenoid valve *2
GV-A

Shut-off valve *3
MAX808/5000/7000

Motorized gas valves

FSG motorized gas valve
CCM21/CCV20

Butterfly valve
V51E

Gas regulators

Pressure regulator *4
RV

Control motors

Control motor
ECM3000

Ignition transformers

Ignition transformer
ATN110-A

High power igniter
S7200

Flameproof explosion-proof ignition transformer
APN4709

Peripheral devices

Flame simulators

Flame simulator
FSP300

Analog flame meters

Analog flame meter
FSP136

*1. C7076A and C7076D are products of Honeywell International Inc.
*2. GV-A is a product of Elster GmbH.
*3. MAX808, MAX5000 and MAX7000 are products of Maxon Corporation.
*4. RV is a product of Maxitrol Company.

Flame
Safeguard
System

Products

- Burner Controllers
- Flame detectors
- Pressure Switch
- Igniter
- Peripheral devices

For detailed specifications, or to learn whether a product is available in a particular country, please contact our sales staff.

CE : This product is certified as complying with CE marking for use in Europe.

UL : This product is certified as complying with a U.S. product safety standard.

CSA : This product is certified as complying with a Canadian product safety standard.

FM : This product is certified as complying with a U.S. product safety standard.

RX Series Burner Interlock Module/Buner Control Module

The RX Series represents the next generation of combustion safety controllers for burners in industrial furnaces.
The burner interlock module (RX-L) and burner control module (RX-R) combine to provide a variety of interlock monitoring and ignition methods.
It is possible to set the interlock monitoring timing or change the ignition method settings by just selecting the preprogrammed safety functions using the PC loader.
Additionally, for flame detection the RX series supports the advanced UV sensor for continuous operation and UV sensor for batch operation, as well as flame rods.

Features

●Provides combustion safety to meet the specifications of the combustion equipment
- Safety features are tailored to equipment specifications by means of the modular structure and wide range of selectable functions.
- Provides a variety of preinstalled safety functions, reducing the time spent on safety circuit review and validation.
- Functions can be selected and executed via the PC loader, without acquiring or creating special software.

●Conservation of space and wiring
- Side connectors between modules carry safety signals such as shutoff commands, eliminating the need for external wiring or relays, saving wiring and space.

●Maintenance support functions
- An operation log (number of starts, operating time, alarm history, etc.) is kept automatically without the need for any special settings.
- Status can be checked as necessary by connecting the PC loader.
- Various monitor outputs tailored to the structure of the combustion equipment are implemented, aiding in understanding the maintenance/troubleshooting situation and in determining the cause of a problem.

  Product status checks: 7-segment LED display
  Front panel indicators: Open collector monitor output
  Remote status monitoring: RS-485 (standard feature)

Buner Interlock Module (RX-L80/90)

The roles of the burner interlock module in the combustion safety architecture are the handling of burner interlock monitoring/processing and of the purge function. A maximum of 32 burner control modules can be combined to easily support multiple burner equipment. This module is also equipped with the ability to connect through RS-485 or Ethernet (only RX-L90) communications, making remote monitoring possible.

● 16 inputs
Individual OFF delay settings (to filter out chattering)
Function input (for batch startup, etc.)
Flame monitoring changeover for 760 °C or higher

● Purge functions
Prepurge from 5 s to 60 min (32 selectable patterns)
Postpurge setting for any time length
Postpurge stop by temperature contacts
Blower output
Motor control

● Displays
Status display (7-segment LED)
Status display (LED)

● Monitor output
22 open collector outputs (freely assignable)
RS-485 communication output (standard feature)

● Ethernet communication (only RX-L90)

Buner Control Module (RX-R40/20)

The roles of the burner control module in the combustion safety architecture are the ignition, flame monitoring, and safety shutoff functions. This unit can be combined with the burner interlock module to support a variety of combustion equipment.

● Ignition functions (for the 3 models below)
- Models with selectable ignition sequences (RX-R40/20)
  Interrupted pilot, intermittent or continuous pilot, direct ignition, flame relay function (selection by PC loader)
- Independent supervision model (RX-44)
  For independent supervision of the pilot and main burner, the RX-R44 and RX-R40 are used together.
- Independent supervision and external relay drive model (RX-46)
  For control of high-frequency loads using time proportional control, ON-OFF control, etc.
- Direct ignition and external relay drive model (RX-R22)
  For control of high-frequency loads using the direct ignition method

● Interlock input
4 inputs

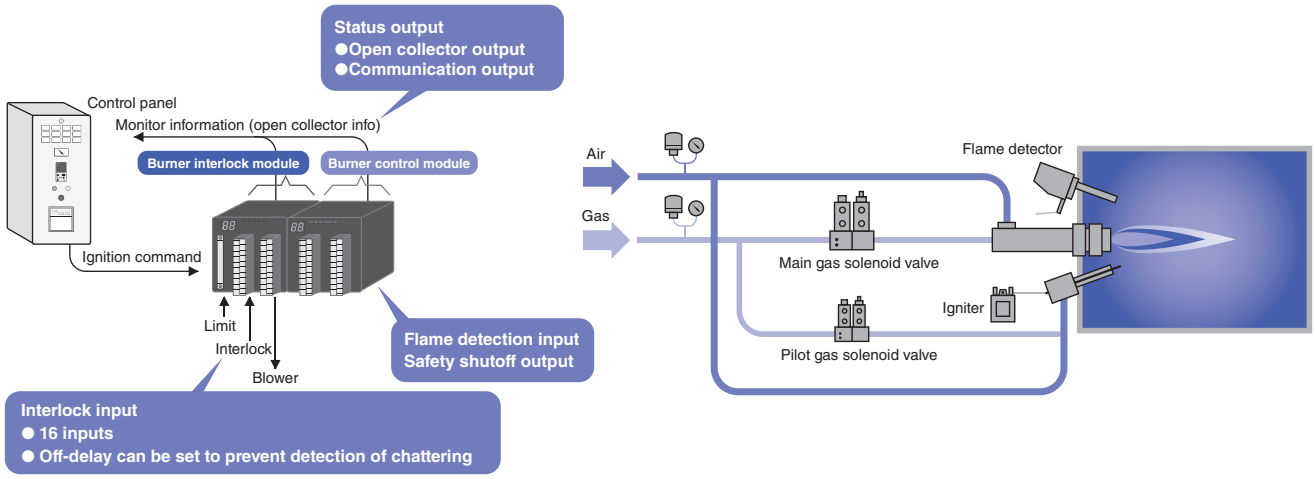
● Main unit displays
Status display (7-segment LED)
Status display (LED)

● Monitor output
11 open collector outputs (freely assignable)

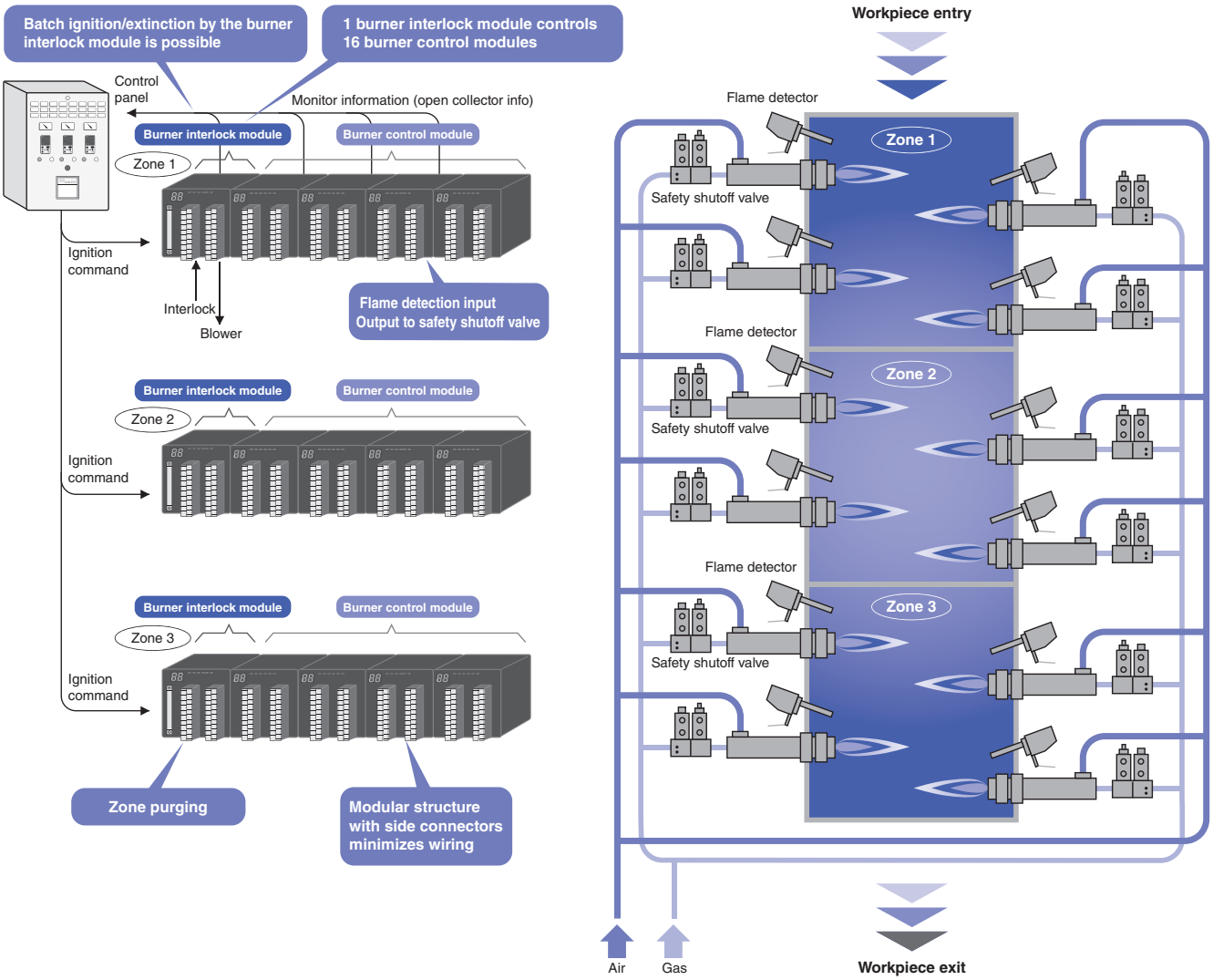
RX Series Burner Interlock Module/Buner Control Module

Sample configurations of single and multiburner systems

Single burner system



Multiburner system



RX-L80/90 Burner Interlock Module

The RX-L80, in combination with the burner control module (RX-R), executes the burner interlock monitoring and prepurge functions.
There are 16 inputs for burner interlock.
In addition to interlock input, this module can handle batch starting of multiple burners or batch ignition of multiple pilot burners.
Status information such as the state of interlocks, alarms, completed purges, etc., can be assigned to 22 transistor outputs and utilized by outputting to control panel indicator lamps or to a PLC for status monitoring.
These functions can be selected easily using the computer loader, without the use of special programs.
This product is equipped with RS-485 or Ethernet (only RX-L90) for the communications function.
Remote monitoring is possible with this device.

Specifications

Operating environment	Ambient temperature		-20 to +55 °C
	Storage temperature		-20 to +70 °C
	Ambient humidity		10 to 90 % RH (without condensation)
	Vibration		0 to 3.2 m/s² (10 to 150 Hz for 2 h each in x, y, and z directions)
	Shock		0 to 9.8 m/s²
Electrical specifications	Rated voltage		24 Vdc
	Allowable supply voltage		21.6 to 26.4 Vdc
	Power consumption		9 W max.
	Dielectric strength		• DC circuit terminals 500 Vac for 1 min · Between 24 Vdc power terminals and input function terminals · Between 24 Vdc power terminals and monitor output connector · Between 24 Vdc power terminals and RX-R/RX-L control signal terminals • AC circuit terminals 1500 Vac for 1 min or 1800 Vac for 1 s · Between power terminals H & G and relay outputs H & G on the one hand, and DC circuit terminals & connectors · Between blower output terminals and DC circuit terminals & connectors · Between control motor output terminals and DC circuit terminals & connectors
	Insulation resistance		At least 50 MΩ with a 500 Vdc megger · Between power supply terminals H & G plus relay outputs H & G on the one hand, and DC terminals & connectors · Between blower output terminals and DC circuit terminals & connectors · Between control motor output terminals and DC terminals & connectors
	Operating life		7 years of continuous use, 10 years of use 8 hours per day, or 100,000 relay contact operations (at 25 °C)
	Startup input		Contact input (24 Vdc, 10 mA) *Usable with devices having contact resistance of 250 Ω or less.
	Reset input		Contact input (24 Vdc, 20 mA) *Usable with devices having contact resistance of 250 Ω or less.
	Interlock input		Contact input (24 Vdc, 20 mA) *Usable with devices having contact resistance of 250 Ω or less.
	Relay output		400 VA (with relay contact welding detection) *1
	Blower output (no-voltage output)		350 VA
	Control motor output (no-voltageoutput)		100 VA
	Monitor outputs (transistor outputs)		22 (0.1 A max. each, 1 A max./module, 30 Vdc max.)
Communication specifications	RS-485 communi-cations	Communication protocol	CPL
		Signal level	RS-485-compliant
		Communication/ synchronization type	Half-duplex, start/stop synchronization
		Maximum cable length	500 m
		Terminating resistor	External (150 Ω, 1/2 W min.)
		Transmission speed	38400 bps max.
	Ethernet comm.	Protocol	MODBUS/TCP
	RX-R control signal	Communication protocol	RX-R control protocol
		Maximum cable length	50 m
	RX-L control protocol	Communication protocol	RX-L control protocol
		Maximum cable length	500 m
General specifications	Mass		Approx. 550 g
	Color		Black
	Structure		Two-piece construction with a separable base and main unit
	Certifications		EN 298 *2 (pending)
Cable specifications	Reset		Max. 10 m
	Interlock contact input		Max. 200 m
	Signal line type/length		See table

*1. Cannot be used for dry output. For relay output, be sure to connect an AC power load (10 VA min.)
*2. Safety and control devices for gas burners and gas burning appliances.

Table 1

Signal	Cable type	Max. cable length
RX-R control	0.2 to 1.5 mm² (AWG 28-14) *1	50 m
RX-L control		500 m
Reset	0.3 to 1.25 mm² (AWG 22-18) *2	10 m
Start		200 m
IN1 to IN16		
RS-485 comm.	0.2 to 1.5 mm² (AWG 28-14) *3	500 m
Blower output	JIS C 3306, 0.75 mm² (dia. 0.18, 30 strands min.)	—
Motor output		

*1. Recommended: JCS4364 cable for light electrical instruments (twisted shielded cable for instruments), 8 cores (4 pairs)
*2. Max. wire dia. 2 mm. Recommended crimp terminal: V1.25-3 (RAV1.25-3), made by JST Mfg. Co., Ltd.
*3. Recommended: JCS4364 cable for light electrical instruments (twisted shielded cable for instruments), 4 cores (2 pairs)

Model Selection

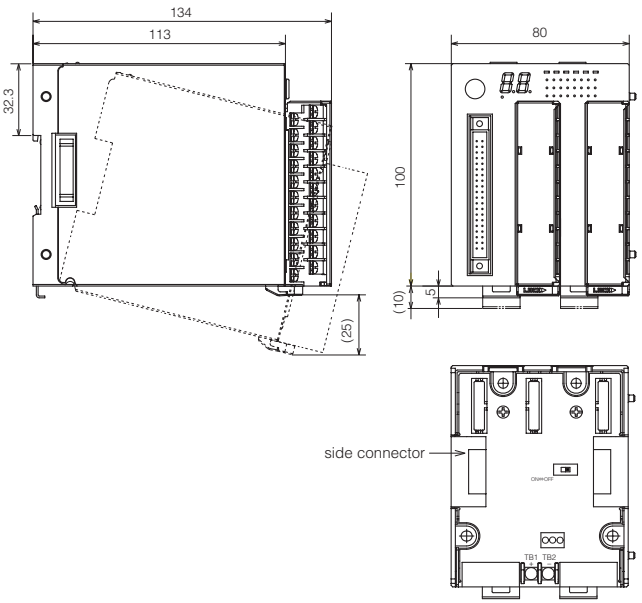
Item	Model No.	Description
Buner interlock module	RX-L80A1010010	RS-485 communications
	RX-L80A101001D	RS-485 + inspection certificate
	RX-L90A1010010	RS-485 and Ethernet
	RX-L90A101001D	RS-485 and Ethernet + inspection certificate

Optional Parts (sold separately)

Item	Model/part No.	Description
Transistor output connector	81446847-001	FCN361J040-AU jack (1, solder type), and FCN-360C040-B cover (1), both made by Fujitsu Components
RX-R/RX-L control signal connector	81447402-001	BL3.5/7SNSW (part No. 161019) made by Weidmuller (qty. 2)
Smart Loader Package	SLP-RXMJ70	For maintenance (with cables)
	SLP-RXMJ71	For maintenance (without cables)
	SLP-RXMJ70	For function selection (with cables)
	SLP-RXMJ71	For function selection (without cables)
Surge absorber	83968019-001	

Dimensions

(Unit: mm)



RX-R40/20 Burner Control Module

The RX-R40/20, in combination with the RX-L burner interlock module and flame detector, handles ignition operations and flame monitoring. If the burner flame goes out, this module executes shutoff safely.
This product supports a variety of flame detectors, including the Advanced UV Sensor (for continuous operation) as well as flame rods.
There are 11 open connector outputs to be used for monitoring, which can be assigned to handle alarms such as ignition failure or flame failure, in addition to the status of the load.
These monitor outputs can be output to the control panel so that the status output and situation can be checked onsite during maintenance or when a sudden problem arises.
These functions can be selected easily using the computer loader, without the use of special programs.

Specifications

Operation modes	Continuous operation (RX-R40 series), batch operation (RX-R20 series)			
Compatible flame detectors	AUD100 series, AUD300/500			
Models	Models with selectable ignition sequences (RX-R40/20) (* Interrupted pilot, intermittent or continuous pilot, direct ignition, flame relay function) Independent supervision model (RX-R44) Independent supervision, external relay drive model (RX-R46) Direct ignition, external relay drive model (RX-R22)			
Sequence timing	Pilot ignition time	Pilot only time	Main ignition time	Flame response time
	4.5 ± 0.5 s, 9 ± 1 s* *Select using the SLP-RX	5 ± 1 s	4.5 ± 0.5 s	3 ± 1 s
Flame voltage range (at standard temp. and humidity and rated voltage)	With flame: 1.5 to 4.0 Vdc Without flame: 0.0 to 0.6 Vdc			
Recommended flame voltage	Stable 2.0 Vdc or more			
Flame voltage output	0 to 5 Vdc			
Environmental specifications	Allowable ambient temperature	-20 to +55 °C		
	Storage temperature	-20 to +70 °C		
	Allowable humidity	10 to 90 % RH (without condensation)		
	Vibration	0 to 3.2 m/s² (10 to 150 Hz for 2 h each in x, y, and z directions)		
	Shock	0 to 9.8 m/s²		
Electrical specifications	Rated voltage	24 Vdc		
	Allowable supply voltage	21.6 to 26.4 Vdc		
	Load power: Rated voltage	100/200/220 Vac (depending on the model No.)		
	Load power: Allowable voltage	-15 to +10 % of the rated voltage		
	Power consumption	8 W max.		
	Dielectric strength	• DC terminals 500 Vac for 1 min, or 600 Vac for 1 s· · Between the 24 Vdc power terminals and the input function terminals · Between the 24 Vdc power terminals and the monitor output connector · Between the 24 Vdc power terminals and the RX-R control signal terminals • AC terminals 1500 Vac for 1 min, or 1800 Vac for 1 s · Between relay outputs and power terminals H and G on the one hand, and DC terminals and connectors on the other		
	Insulation resistance	50 MΩ min. with a 500 Vdc megger ·Between relay outputs and power terminals H and G on the one hand, and DC terminals and connectors on the other		
	Operating life	7 years of continuous use or 100 000 relay contact operations (at 25 °C)		
	Startup input	Contact input (24 Vdc, 10 mA) *Usable with devices having contact resistance of 250 Ω or less.		
	Reset input	Contact input (24 Vdc, 20 mA) *Usable with devices having contact resistance of 250 Ω or less.		
	Interlock input	Contact input (24 Vdc, 20 mA) *Usable with devices having contact resistance of 250 Ω or less.		
	Contact capacity	Ignition transformer: 300 VA., Pilot valve: 200 VA., Main valve: 200 VA		
	Monitor outputs	11 (each 0.1 A max., 0.8 A max./module., 30 Vdc max.)		
General specifications	Mass	Approx. 600 g		
	Color	Black		
	Structure	Two-piece construction with a separable base and main unit		
	Standards compliance	EN 298 (pending)*		
Wire and cable specifications	Flame detector	• AUD100 series, AUD 300C/500C Signal wires F, G: 600 V, indoor PVC insulation (IV wire, JIS C3307), 2 mm², max. length 200 m • Flame rod Signal wires F, G: 5C-2V or 7C-2V high-frequency coaxial cable		
	Reset	Max. cable length: 10 m.		
	Interlock contact input	Max. cable length: 200 m.		
	Signal line type/length	Refer to table 1.		

* EN 298: Automatic gas burner control systems for gas burners and gas burning appliances with or without fans.

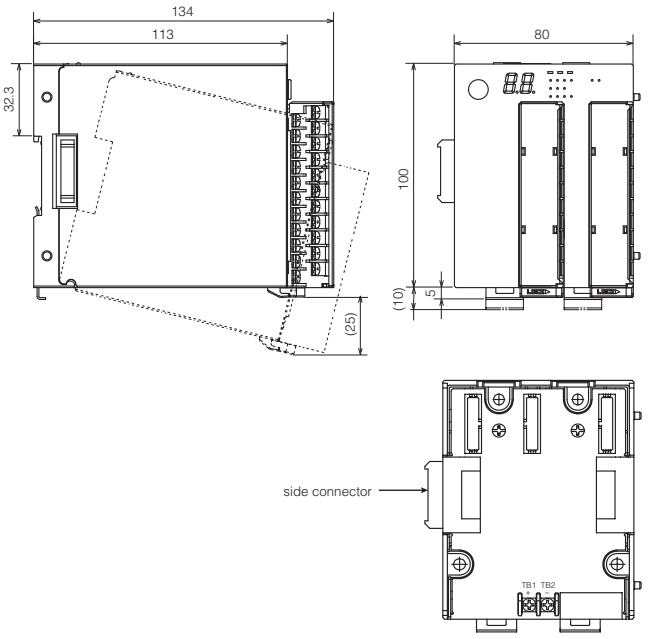
Table 1

Signal	Cable type	Max. cable length
RX-R control signal	0.2 to 1.5 mm² (28-14 AWG)*	50 m
Reset signal	0.3 to 1.25 mm² (22-16 AWG)	10 m
Start signal		200 m
IN1 to IN4		

* Recommended: JCS4364 cable for light electrical instruments (twisted shielded instrument cable), 8 cores (4 pairs)

Dimensions

(Unit: mm)



RX-R40/20 Burner Control Module

Overview of settings

Setting		No.	Description
Model type settings	Combustion mode selection	1-1	Selects the combustion mode.
	RX-R purge conditions	1-2	Toggles air pressure switch operation check ON/OFF.
	Pilot ignition time	1-3	Selects a pilot ignition time.
	(Not used)	1-4	—
	760 °C mode setting.	1-5	Selects whether or not 760 °C mode is used.*3
Control settings	Startup conditions	2-1	Selects startup conditions for RX-R.
	Reset conditions	2-2	Selects conditions for canceling lockout.
	Standby time after recovery from lockout	2-3	Sets the standby time before ignition when restarting a locked-out RX-R. The process will not proceed during standby, even if a startup signal is received.
	Startup delay time	2-4	Sets a delay time for beginning the start check.
	Air valve OFF delay time for combustion	2-5	Sets the air valve output OFF delay time for combustion*1
	Timeout time for air pressure OFF confirmation	2-6	Sets a timeout time if there is a failure to confirm that the air pressure switch input is OFF during the start check.*2
Input settings	Input functions	3-1	Selects the input functions of IN1 to IN4.
	Interlock OFF delay	3-2	Selects the OFF delay time for IN1 to IN4.
RX-R control settings	RX-R station address	4-1	Sets the RX-R control communication station address.
Monitor output settings	Flicker setting	5-1	Selects a flicker display for an interlocked output (ON/OFF alternating output).
	Monitor output settings	5-2	Selects signals for assignment to monitor outputs 1 through 11 (M-1 to M-11).
	Monitor output logic	5-3	Sets monitor output logic (direct, reverse), excluding alarm output (MS-AL-P, MS-AL-N).
Display settings	Warning display settings	6-1	Selects a warning display method for the 7-segment LED on front of the module.

*1. Valid with the following settings.
· RX-R purge conditions (1-2) = "ON"
· In Monitor output settings (5-2), monitor outputs M-9 to M-11 = "AV-DRV"
*2. Valid when RX-R purge conditions (1-2) = "ON."
*3. 760 °C mode is disabled for the RX-R20 series regardless of settings.

Model Selection

●Models with selectable ignition sequence RX-R40/20

Model No.	Flame detector	Flame response	Load power
RX-R40C013100	AUD300C/500C	3 ± 1 s *1	100 Vac
RX-R40C013200			200 Vac
RX-R40C013600			220 Vac
RX-R20C013100	AUD100/110 (AUD15)	3 ± 1 s *1	100 Vac
RX-R20C013200			200 Vac
RX-R40B013100	Flame rod	3 ± 1 s *2	100 Vac
RX-R40B013200			200 Vac
RX-R20B013100	Flame rod	3 ± 1 s *2	100 Vac
RX-R20B013200			200 Vac

*1. At a flame voltage of 3 V.
*2. At a flame voltage of 2 V.
Time-limited pilot/overlapping pilot/direct ignition etc. can be selected with the loader.
Suffix "D": inspection certificate included.
Example: RX-R40C01310D

●Individual monitoring model RX-R44

Model No.	Flame detector	Flame response	Load power
RX-R44C013100	AUD300C/500C	3 ± 1 s *1	100 Vac
RX-R44C013200			200 Vac
RX-R44C013600			220 Vac
RX-R44B013100	Flame rod	3 ± 1 s *2	100 Vac
RX-R44B013200			200 Vac

*1. At a flame voltage of 3 V.
*2. At a flame voltage of 2 V.
Suffix "D": inspection certificate included.
Example: RX-R44C01310D

●Individual monitoring, external relay drive model RX-R46

Model No.	Flame detector	Flame response	Load power
RX-R46C013100	AUD300C/500C	3 ± 1 s*	100 Vac
RX-R46C013200			200 Vac
RX-R46C013600			220 Vac

* At a flame voltage of 3 V.
For time proportioning control or ON-OFF control of high-frequency loads, this model was designed so that the load can be connected to the outside of the RX-R.
Example: RX-R46C01310D

●Direct ignition, external relay drive model RX-R22

Model No.	Flame detector	Flame response	Load power
RX-R22C013100	AUD100/110 (AUD15)	3 ± 1 s*	100 Vac
RX-R22C013200			200 Vac

* At a flame voltage of 3 V.
Suffix "D": inspection certificate included.
Example: RX-R22C01310D

Optional Parts (sold separately)

Item	Model no./part no.	Description
RX-R/RX-L control signal connector	81447402-001	BL3.5/7SNSW (2) (Part no.: 161019) made by Weidmuller
Smart Loader Package	SLP-RXMJ70	For maintenance (with cables)
	SLP-RXMJ71	For maintenance (without cables)
	SLP-RXEJ70	For function selection (with cables)
	SLP-RXEJ71	For function selection (without cables)
Surge absorber	83968019-001	

Combining and wiring the RX-L80/90 and RX-R40/20

1.The method of combining the RX-L80/90 and RX-R40/20 depends upon how the pilot burner and main burner operate.
2.Configuration according to operation method, and wiring of terminal block A

•Interrupted pilot
- For continuous operation equipment (applicable to batch operation as well)

RX-L80 /90	RX-R40

- For batch operation equipment

RX-L80 /90	RX-R20

•Intermittent pilot, continuous pilot
- For continuous operation equipment (applicable to batch operation as well)

RX-L80 /90	RX-R44	RX-R40

- For a device with continuous operation and external relay drive (applicable to batch operation as well)

RX-L80 /90	RX-R46	RX-R40

•Direct ignition
- For batch operation equipment with direct ignition and external relay drive

RX-L80 /90	RX-R22

AUD300C1000 Advanced Ultraviolet Flame Detector

The AUD300C1000 Advanced Ultraviolet Flame Detector is designed to detect ultraviolet radiation from an oil or gas burner flame, for use with both batch and continuous operation.
The AUD300C is used in combination with a dedicated burner controller. By means of the built-in shutter, any malfunction of the UV flame detector or burner controller is detected by the continuous self-checking (Dynamic Self-Check) function, ensuring highly reliable combustion safety control.

Specifications

Applicable types of flames *1	City gas, Natural gas, Propane gas, Kerosene, Heavy oil, Coke oven gas, Hydrogen, Chlorine, Ammonia, Naphtha, Ethylene, etc.
Combined burner controller	RX-R40, RX-R44, RX-R46, AUR450C, AUR300C, AUR350C
Shutter voltage	Approx. 24 Vdc (supplied from Burner Controller)
Self-checking cycle	Approx. 75 cycles/ min.
Insulation resistance	Between flange unit mounting conduit and F-terminal (or blue lead wire), between flange unit mounting conduit and G-terminal (or yellow lead wire), between flange unit mounting conduit and S1-terminal (or white lead wire), between flange unit mounting conduit and S2-terminal (or white lead wire): 50 MΩ min. by 500 Vdc megger at the above each location. (However, the tube unit must be removed.)
Dielectric strength	Between flange unit mounting conduit and F-terminal (or blue lead wire), between flange unit mounting conduit and G-terminal (or yellow lead wire), between flange unit mounting conduit and S1-terminal (or white lead wire), between flange unit mounting conduit and S2-terminal (or white lead wire): 1500 Vac for 1 min or 1800 Vac for 1 sec at the above each location. (However, the tube unit must be removed.)
During flame detection (while the shutter is opening and closing)	-20 to +120 °C (However, when no flame is detected (shutter continuously open), the maximum ambient operating temperature is 100 °C.)
Ambient storage temperature	-20 to +70 °C
Ambient humidity	90 %RH at 40 °C max. (without condensation)
Vibration resistance	4.9 m/s² max., 10 to 55 Hz for 2 hours each in X, Y and Z directions
Impact resistance	300 m/s² in vertical and horizontal directions
Pressure resistance for flange	350 kPa
Protection	IP66 (except a conduit tube connection port)
Mounting posture	-45 to +90° (in vertical direction)
Mounting	G1 (at the mounting section for sighting pipe)
Lead wires	AWG18 heat resistant silicone cables, with 2.4 m color lead wires
Electric wire pipe mounting conduit	1/2-14NPSM
Flame signal wire requirements and extension distance	Requirements: 600 V vinyl insulation wires, IV wires with 2.0 mm², Max. 200 m
Materials	Main body: Heat resistant resin Mounting section: Aluminum
Main body color	Purple (equivalent to DIC257)
Weight	Approx. 630 g
Expiration date of tube unit and shutter unit	3 years
Standards compliance *2	CE, UL, CSA

*1 For applications using coke oven gas, hydrogen, chlorine, ammonia, naphtha, ethylene, etc., in which the burner structure may impose restrictions on the mounting of the flame detector, it is necessary to check that flame monitoring is reliable.
*2 Standards approvals are valid only for a combination of AUR450C, AUD300C, and Q241A104

● For further details, please refer to specifications sheet No. CP-SS-1806E.

Model Selection

Item	Model No.	Lens type	Additional features	Special treatment
Advanced ultraviolet flame detector	AUD300C1000	Standard	None	None
	AUD300C100D		Inspection certificate provided	None
	AUD300C100T		None	Tropicalization
	AUD300C100DT		Inspection certificate provided	Tropicalization
	AUD300C1100	Condenser	None	None
	AUD300C110D		Inspection certificate provided	None
	AUD300C110T		None	Tropicalization
	AUD300C110DT		Inspection certificate provided	Tropicalization

Optional Parts (sold separately)

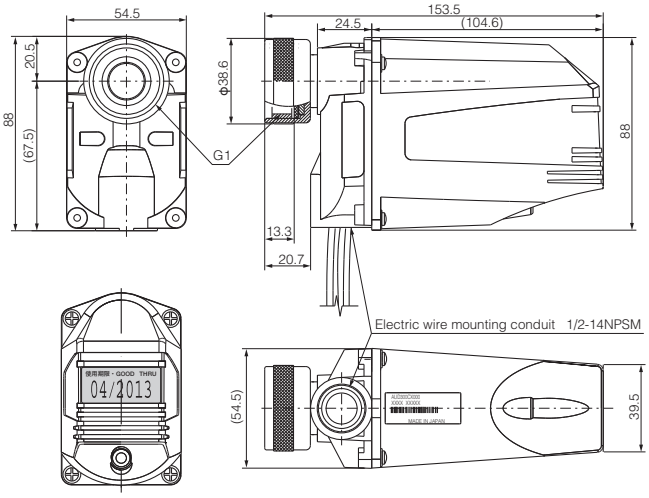
Item	Model No.
Bushing 1×¾	81409780-001
Packing nut	81409482-001

Maintenance Parts (sold separately)

Item		Model No.
AUD Maintenance Kit (includes shutter and tube units)	No inspection certificate	AUD60A1000
	Inspection certificate included	AUD60A100D

Dimensions

(Unit: mm)



◆ AUD Maintenance Kit ◆

〈Model No.:AUD60A1000〉

The AUD maintenance kit includes the assembled tube unit and shutter unit, as well as consumables such as the main unit flange and O-ring for the cover, expiration label, etc.

❇ 1:Expiration date label

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AUD500C11000 Advanced Ultraviolet Flame Detector

The AUD500C Explosion-Proof Advanced Ultraviolet Flame Detector (hereafter referred to as the AUD500C) is designed to detect ultraviolet radiation from an oil or gas burner flame, for use with both batch and continuous operation.
The AUD500C is used in combination with a dedicated burner controller. By means of the built-in shutter, any malfunction of the UV flame detector or burner controller is detected by the continuous self-checking (Dynamic Self-Check) function, ensuring highly reliable combustion safety control.

Specifications

Explosion-proof housing	Ex d IIC T4
Explosion-protection certified	Product qualified by Technology Institution of Industrial Safety (TIIS) and National Supervision and Inspection Center for Explosion Protection and Safety Instrumentation (NEPSI).
Applicable types of flame*1	City gas, natural gas, propane gas, kerosene, heavy oil, coke oven gas, hydrogen, chlorine, ammonia. naphtha, ethylene, etc.
Shutter voltage	Approx. 24 Vdc (supplied from Burner Controller)
Self-checking cycle	Approx. 75 cycles / min
Insulation resistance	Between flange mounting part and F-terminal (or blue lead wire), between flange mounting part and G-terminal (or yellow lead wire), between flange mounting part and S1-terminal (or white lead wire), between flange mounting part and S2-terminal (or white lead wire): 50 MΩ min. by 500 Vdc megger at each of the above locations. (However, the tube unit must be removed)
Dielectric strength	Between flange mounting part and F-terminal (or blue lead wire), between flange mounting part and G-terminal (or yellow lead wire), between flange mounting part and S1-terminal (or white lead wire), between flange mounting part and S2-terminal (or white lead wire): 1500 Vac for 1 min or 1800 Vac for 1 s at each of the above locations. (However, the tube unit must be removed)
Ambient temperature	-20 to +60 °C
Ambient storage temperature	-20 to +70 °C
Ambient storage humidity	90 % RH at 40 °C max. (without condensation)
Vibration resistance	4.9 m/s² max., 10 to 55 Hz for 2 hours each in X, Y and Z directions
Pressure resistance for mounting part	690 kPa
Protection	IP67
Mounting posture	-45 to +90° (in vertical direction)
Mounting (on the monitoring pipe)	Flange: Parallel pipe thread G2-1/4, Adapter: Taper pipe thread R1
Accessory cable length	AWG18 heat-resistant silicone cables (4 cores), 3 or 10 m (depending on the model number)
Flame signal wire requirements and extension distance	IV wires with 2.0 mm² and max. 200 m in length
Materials	Aluminum
Color	Purple (equivalent to DIC257)
Mass	Approx. 2.5 kg
Expiration date of tube unit and shutter unit	3 years

*1. For applications using coke oven gas, hydrogen, chlorine, ammonia. naphtha, ethylene, etc., in which the burner structure may impose restrictions on the mounting of the flame detector, it is necessary to check that flame monitoring is reliable.

● For further details, please refer to specifications sheet No. CP-SS-1873E.

Maintenance parts (sold separately)

Item	Model No.
AUD Maintenance Kit (includes shutter and tube units)	AUD60A1010

◆ AUD Maintenance Kit ◆

〈Model No.:AUD60A1010〉

The AUD60A1010 maintenance kit includes the assembled shutter unit and tube unit, as well as consumables such as the AUD500C main unit flange and tight-fitting cover O-ring, expiration label, etc.

✻ 1:Expiration date label

Example of an attached label

Model Selection

Item	Accessory cable length	Lens type	Model No
Advanced ultraviolet flame detector	3 m	Standard	AUD500C1100__
	10 m		AUD500C1110__
	3 m	Condenser	AUD500C1101__
	10 m		AUD500C1111__

Replace the blank (_ _) in the mobel number with one of the for choices below.
0: Standard product
D: Inspection certificate included
OT: Tropicalization
DT: Inspection certificate + tropicalization
Y: Traceability certificate included
E: Heavy duty coating + inspection certificate

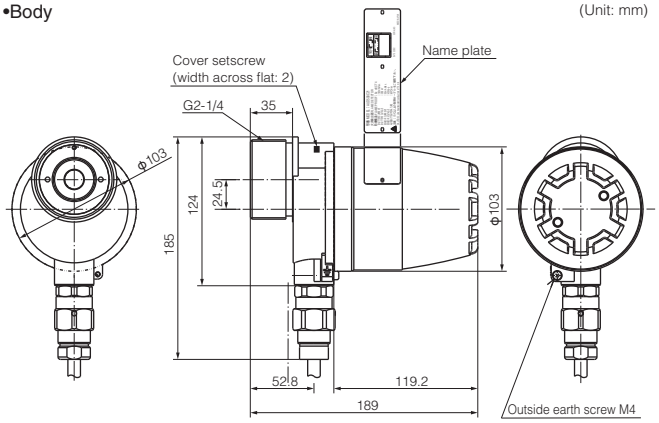
Optional parts (sold separately)

Note: This item is necessary.

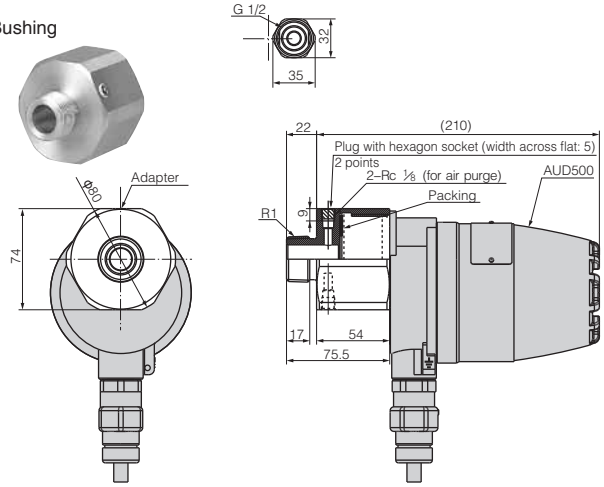
Item	Model No.
Adapter (G2-¼→ R1)	81441151-001

Dimensions

•Body (Unit: mm)



•Bushing



AUD100/110 Advanced Ultraviolet Flame Detector Socket for the AUD15 Tube Unit

The AUD100/110 is a dedicated socket for the AUD15 tube unit, and is designed for monitoring batch operation oil or gas burner combustion.
Two models, the AUD100 lead-wire model and the AUD110 terminal block model, are available to meet wiring or installation requirements.

AUD100

AUD110

AUD15
(tube unit)

Specifications

Item	Description	
Applicable type of fuel *1	City gas, natural gas, propane gas, kerosene, heavy oil, coke oven gas, hydrogen, chlorine, ammonia. naphtha, ethylene, etc.	
Mass	AUD100C	AUD110C
	Approx. 120 g (with the AUD15: approx. 140 g)	Approx. 120 g (with the AUD15: approx. 140 g)
Materials	Aluminum	Socket: Aluminum Terminal block: Heat-resistant resin (PBT + GF30) (black)
Insulation resistance	50 MΩ min by 500 Vdc megger (between each lead wire and the metal part of socket when the AUD15 is removed)	50 MΩ min by 500 Vdc megger (between each of terminals F and G and the metal part of socket when the AUD15 is removed)
Dielectric strength	1500 Vac for 1 min or 1800 Vac for 1 s (between each lead wire and the metal part of socket when the AUD15 is removed)	1500 Vac for 1 min or 1800 Vac for 1 s (between each of terminals F and G and the metal part of socket when the AUD15 is removed)
Ambient temperature	-20 to +120 °C	
Ambient storage temperature	-20 to +70 °C	
Ambient humidity	90 % RH at 40 °C (without condensation)	
Allowable pressure	35 kPa	
Vibration resistance	5 m/s² max. (10 to 60 Hz for 2 hours each in X, Y and Z directions)	
Protection	IP65 (JIS C 0920/IEC 60529) with pipes and wires connected	
Mounting nut	G1 (R1 and 1-11BSP are connectable)	
Lead wires	AWG #18 (approx. 1.2 mm²) flame retardant cross-linked polyethylene insulated cable, approx. 1800 mm long (blue and white) (only AUD100)	
Conduit	G1/2 (1/2-14BSPP is connectable)	
Flame signal wire	Standard: 2.0 mm², 600 Vac cable with PVC insulation ("IV cable"). Max. length: approx. 200 m	

*1. For applications using coke oven gas, hydrogen, chlorine, ammonia. naphtha, ethylene, etc., in which the burner structure may impose restrictions on the mounting of the flame detector, it is necessary to check that flame monitoring is reliable.

● For further details, please refer to specifications sheet No. CP-SS-1877E.

Model Selection

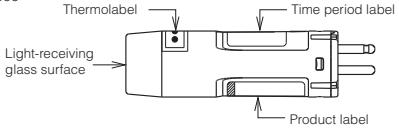
Item	Model No.
Lead-wire model without the AUD15	AUD100C100_
Lead-wire model with the AUD15	AUD100C1000-A15
Terminal block model without the AUD15	AUD110C100_
Terminal block model with the AUD15	AUD110C1000-A15

Replace the blank (_) in the mobel number with one of the for choices below.
0 : Standard
D : Inspection certificate
T*: Tropicalization treatment
B*: Inspection certificate + tropicalization treatment
* Only AUD110 Series

Optional parts (sold separately)

Item	Model No.
Tube unit (ultraviolet photoelectric tube) *1	AUD15C1000
Seal adapter *2	81403159
Analog flame meter	FSP136A100
Flame simulator	FSP300C100
Lens unit (focal length: 70 mm)	FSP100L70000
Lens unit (focal length: 70 mm) with inspection certificate	FSP100L7000D
Lens unit (focal length: 30 mm)	FSP100L30000
Lens unit (focal length: 30 mm) with inspection certificate	FSP100L3000D

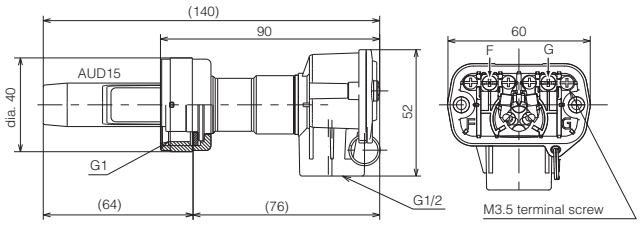
*1. AUD15C1000



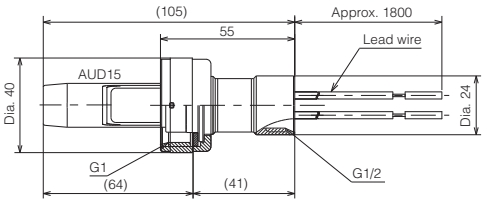
*2. Seal adapter (model No. 81403159)
Refer to the following dimensions

Dimensions

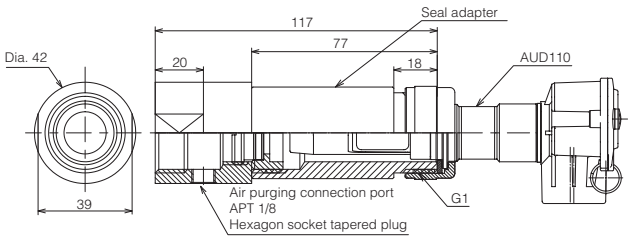
●AUD110C100_ with the AUD15 (Unit: mm)



●AUD100C100_ with the AUD15



●Seal adapter (model No.: 81403159)



AFD100A/B Visible Light Frame Detector

The AFD100A/B visible light flame detector is a batch operation flame sensor that detects visible light from an oil combustion burner flame.
There are two different types for different burner constructions, depending on whether the light is received from the front or side.

Be sure to combine this product with the burner controller appropriate for the AFD100.

C554A compatible replacement adapter

Specifications

Model	Direction light received	Type	Compatible Burner controller
AFD100A0700	Front	Top view	R4424 or R4440H series product that supports AFD
AFD100B0700	Side	Side view	
Illuminance-current characteristics (Conditions: VR = 5 V, at 25 °C)	At an illuminance of 10 lx (color temperature of 2,856 K), 30 μA or more. (Measurement conditions: supply voltage: 5 V, load resistance: 20 kΩ, room temperature/normal humidity)		
Dark characteristics	In total darkness (0 lx), 24 μA or lower. (Measurement conditions: supply voltage: 5 V, load resistance: 20 kΩ, room temperature/normal humidity)		
Dielectric strength	Commercial frequency 500 Vac, applied for 1 minute with no abnormalities (Between lead wires and flange, at room temperature and normal humidity)		
Insulation resistance	With a 500 Vdc megger, 50 MΩ or more. (Between lead wires and flange, at room temperature and normal humidity)		
Allowable ambient temperature	-20 to +60 °C		
Storage temperature	-20 to +70 °C		
Allowable ambient humidity	40 °C, 90 % RH or less (without condensation)		
Vibration resistance	Double amplitude 4.9 m/s², 10-55 Hz, 2 hours each in X, Y, Z directions		
Cable	Heat-resistant flat plastic cable, 0.75 mm² Black (terminal F), white (terminal G)		
Material	Main unit/flange: nylon 6 (blue)		
Mounting	Flange		
Mass	Approx. 25 g		

Model Selection

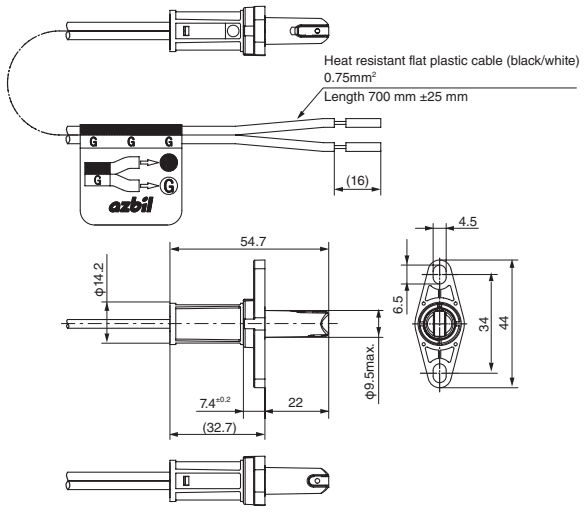
Item	Type	Model No.
Visible light flame detector	Top view	AFD100A0700
	Side view	AFD100B0700

Optional Parts (sold separately)

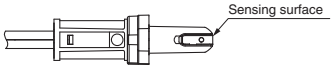
Item	Model No.
C554A1299-1 compatible replacement adapter	81447108-001
C554A06S1-1 compatible replacement adapter	81447108-002

Dimensions

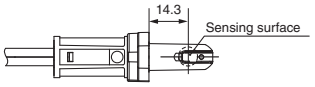
(Unit: mm)



●AFD100A0700 (top view type)



●AFD100B0700 (side view type)



AFD110A Visible Light Flame Detecter

The AFD110A visible light flame detector is a batch operation flame sensor that detects visible light from an oil combustion burner flame.

This product must be combined with an AFD-compatible Burner controller.

Specifications

Illuminance-current characteristics (Conditions: VR = 5 V, at 25 °C)	At an illuminance of 10 lx (color temperature of 2,856 K), 30 μA or more. (Measurement conditions: Supply voltage: 5 V, load resistance: 20 kΩ, room temperature/normal humidity)
Dark characteristics	In total darkness (0 lx), 24 μA or lower. (Measurement conditions: Supply voltage: 5 V, load resistance: 20 kΩ, room temperature/normal humidity)
Dielectric strength	Commercial frequency 500 Vac, applied for 1 minute with no abnormalities. (Between lead wires and flange, at room temperature and normal humidity)
Insulation resistance	With a 500 Vdc megger, 50 MΩ or more. (Between lead wires and flange, at room temperature and normal humidity)
Allowable ambient temperature	-20 to +60 °C
Storage temperature	-20 to +70 °C
Allowable ambient humidity	40 °C, 90 % RH or less (without condensation)
Vibration resistance	Double amplitude 4.9 m/s^2, 10-55 Hz, 2 hours each in X, Y, Z directions
Cable	Heat-resistant flat plastic cable, 0.75 mm^2 Black (terminal F), white (terminal G)
Protection	IP44 (with conduit and wiring connected)
Material	Aluminum
Mounting	G3/4 inch flange
Compatible burner controllers	R4424 or R4440H series product that supports AFD
Mass	Approx. 200 g

Model selection

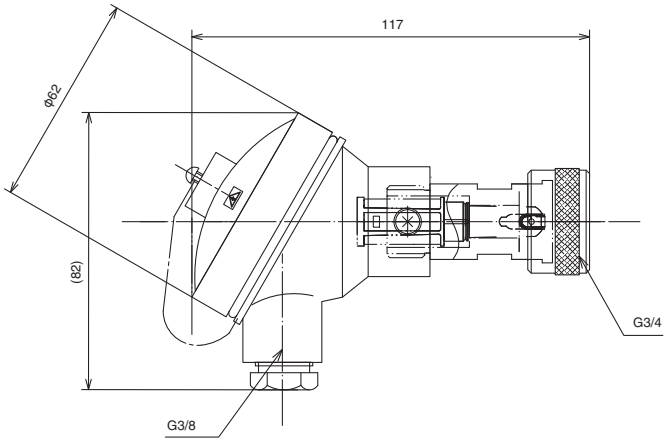
Item	Model No.
Visible light flame detector	AFD110A0000

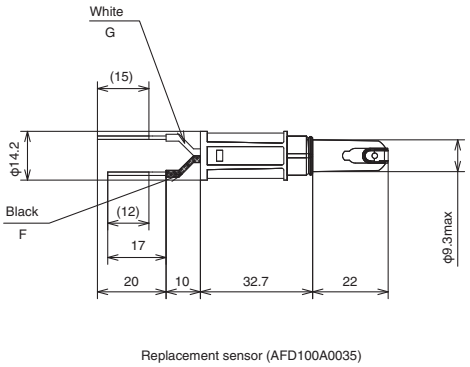
Optional Parts (sold separately)

Item	Model No.
Replacement sensor	AFD100A0035

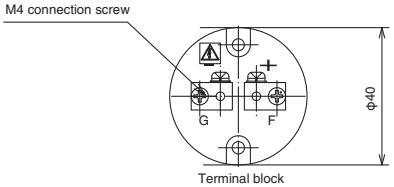
Dimensions

(Unit: mm)





Replacement sensor (AFD100A0035)



Terminal block

C6097A Gas Pressure Switch

The C6097A gas pressure switch is a pressure detector for city gas, natural gas, LP gas and air.
The external electrical circuit is turned on or off according to the preset value.
This device can be used in a variety of ways including detection of maximum/minimum gas/air pressure supplied to the gas burning device, burner blower interlock, or filter clogging.
As a supplementary part (sold separately), there is a switch-action display light for switching the gas pressure.

Specifications

Applicable fluids	Natural gas, liquefied petroleum gas, and air				
Model	C6097A0110	C6097A0210	C6097A0310	C6097A0410	C6097A0510
Control action	ON/OFF	ON/OFF	ON/OFF	ON/OFF	ON/OFF
Setting range	0.1 to 1 kPa	0.25 to 5 kPa	3 to 15 kPa	10 to 50 kPa	10 to 70 kPa
On-off differential (nominal value)	40 Pa (fixed)	60 Pa (fixed)	280 Pa (fixed)	700 Pa (fixed)	800 Pa (fixed)
Maximum Allowable pressure	20 kPa	30 kPa	50 kPa	150 kPa	150 kPa
Setting accuracy	0.1 ±0.06 kPa, 1 ±0.15 kPa	0.25 ±0.15 kPa, 5 ±0.75 kPa	3 ±0.9 kPa, 15 ±2.25 kPa	10 ±2.4 kPa, 50 ±7.5 kPa	10 ±3 kPa, 70 ±8 kPa
	Low pressure side: when at atmospheric pressure. High pressure side: when pressure is increasing.				
Output	SPDT contact output On pressure down, terminals 1-3 closed, terminals 2-3 open. On pressure rise, terminals 1-3 open, terminals 2-3 closed.				
Contact raiting	Resistive load: 250 Vac, 5 A Inductive load: 250 Vac, 3 A (power factor: 0.6) Minimum contact operating current and voltage: 50 mA, 24 Vdc				
Insulation resistance	100 MΩ min. between each terminal and non-live metal part with a 500 Vdc megger				
Dielectric strength	Betw. terminals with the same polarity: 1000 Vac, 50/60 Hz for 1 min Betw. each terminal and non-electrically charged metal parts: 1500 Vac, 50/60 Hz for 1 min Leakage current of 1 mA or less under these conditions				
Contact resistance	Initial 100 mΩ max. (measured by voltage drop method at 6–8 Vdc and 1 A)				
Fluid temperature	-15 to +60 °C (without freezing or condensation)				
Ambient temperature	-15 to +60 °C (without freezing or condensation)				
Durability	Over 100,000 operations at the rated contact voltage and current				
Wiring terminal	M3.5 screw terminal				
Installation direction	Vertical, or horizontal with the pressure setting dial facing upwards.				
Protection	IP54				
Mass	260 g				
High-pressure gas contacting material	Die-cast aluminum (housing), NBR/nitrile rubber (diaphragm)				
Accessories (sold separately)	Switch operation indicator lamp (100/200 Vac) Model No.: **81404156**				

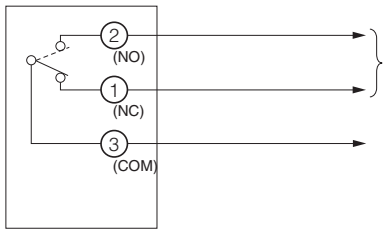
Model Selection

Item	Model No.
Gas pressure switch	C6097A0110
	C6097A0210
	C6097A0310
	C6097A0410
	C6097A0510

Optional Parts (sold separately)

Item	Model No.
Switch operation indicator lamp (100/200 Vac)	81404156

Wiring

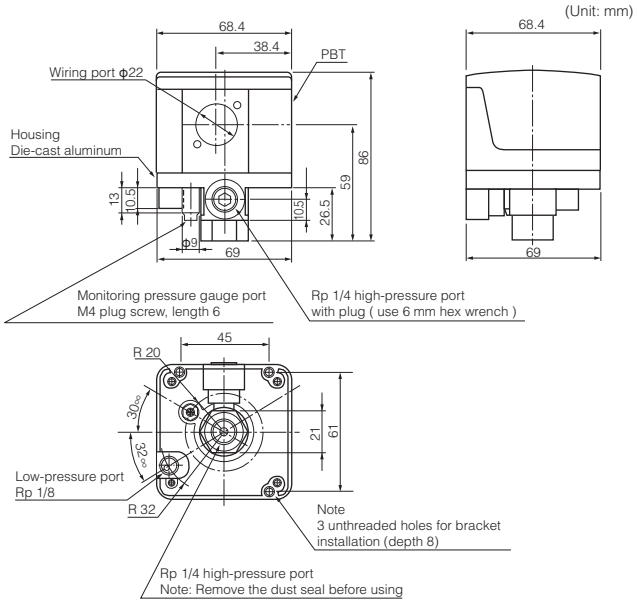


For a pressure rise:
Terminals 3–1 open
Terminals 3–2 closed

For a pressure drop:
Terminals 3–1 closed
Terminals 3–2 open

Dimensions

(Unit: mm)



Note. Use M4 self-tapping screw or provide the hole with M4 threads before use.

S7200A High Power Igniter

The S7200A igniter is a solid-state, high performance ignition transformer used with business and industrial oil-fired gun-type burners and gas-fired power burners.
Compared with our other products, this unit has twice the ignition energy, equivalent to the amount of a coil ignition transformer, therefore making it possible to use this transformer with burners that previously could be ignited only by using a coil ignition transformer.
Compared to the S720, the high-voltage cable can be extended to 2 meters, and at that length the power does not drop.

Specifications

Applicable burner	Oil-fired gun-type burner		Gas-fired power burner	
Model	S7200A100–OHR	S7200A200–OHR	S7200A100–GHR	S7200A200–GHR
Rated power and voltage	100 Vac 50–60 Hz	200 Vac 50–60 Hz	100 Vac 50–60 Hz	200 Vac 50–60 Hz
No. of electrodes	2		1	
Recommended air speed	10 + 15 m/s		10 + 15 m/s	
Time rating	60 min, 50 % *1		6 min, 20 %	
	Note: The percentage figure is the allowable usage rate for continuous ignition. For example, "6 min, 20 %" means that 1.2 min is the max. continuous discharge time (4.8 min rest).			
Characteristics	Half-wave			
High-voltage side connection	Bullet terminal			
Grounding method	Neutral ground		One ground wire	
Power consumption	70 VA	75 VA	55 VA	65 VA
Mass	Approx. 650 g			
Operating voltage	-15 % to +10 % of rated supply voltage			
High voltage side output voltage	Approx. 20 kV^{o-p} *2		Approx. 16 kV^{o-p} *2	
Recommended electrode spacing	3.5 ±0.5 mm		2.5 ±0.5 mm	
Electrical life	100,000 operations or 10 years under standard conditions (rated supply voltage, air speed between electrodes, room temperature, normal humidity)			
Induced lightning surge resistance	10 kV or more between wires and between wires and ground (1.2/50 µs, 100 Ω or more)			
Insulation resistance	Between ground terminal and input terminals using a 500 Vdc megger, 50 MΩ or more (excluding high voltage terminals)			
Dielectric strength	Between ground terminal and input terminals, 1800 Vac, 1 s without abnormalities (excluding high voltage terminals)			
Operating ambient temperature	-20 to +60 °C			
Operating ambient humidity	90 % RH or less at 40 °C (no leak discharge due to condensation between the secondary terminals and the secondary terminal and ground)			
Storage ambient temperature	-20 to +60 °C			
Ground terminal	If there is poor electrical contact between the ground terminal and the burner main unit, high frequency noise will occur and create electrical interference in other equipment, radios, TVs, etc. Be sure to remove the paint from the point of contact on the burner so that there is a good connection.			
Recommended high voltage cable	Standards /Dimensions	High-voltage AIRN (JIS3405) cable for use in vehicles or neon light wiring, 300 mm (standard) to 2000 mm (maximum) in length. (However, if the wire is longer than 600 mm, use an insulator to raise it by at least 50 mm. Separate the cables by at least 3 cm.)		
	Pullout strength	More than 290 kPa. AIRN cable (JIS3405) must be used to prevent the cable from pulling out during transport or under use conditions.		
Power cord	500 ±30 mm (plastic cabtyre cable, 2 cores / VCTFK, JIS3306 / 0.75 mm^2, 30/0.18 diameter 4.4 × 6.8 black)			
Case material	Polycarbonate			
Case color	Black			
Mounting	Mounted on metal plate (1 mm thick or more)			
Mounting position	Mounted such that ground terminal makes contact with metal plate.			

*1. This is the value when used in an ambient temperature of less than 40 °C and is 60 min. and 33 % when used in an ambient temperature between 40 °C and 60 °C.
*2. For the rated voltage, room temperature, normal humidity and 20 pF voltage divider input capacity.

Model selection

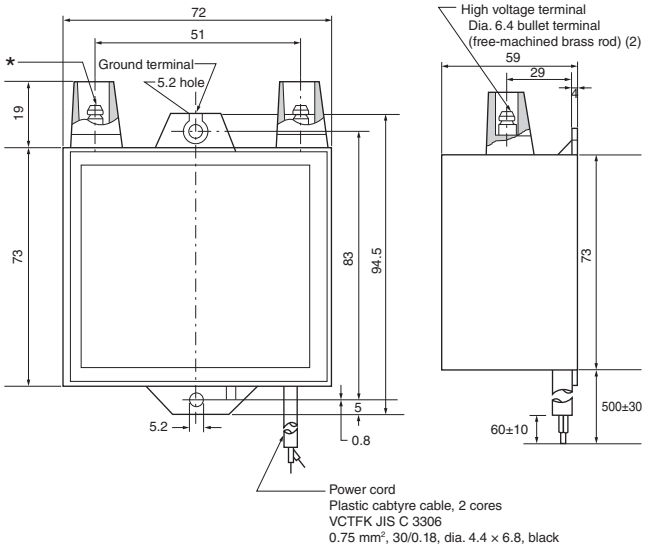
Item	Model No.
Gun type oil burner	S7200A100-OHR
	S7200A200-OHR
Power gas burner	S7200A100-GHR
	S7200A200-GHR

Optional Parts (sold separately)

Item	Cable length	Model No.
High voltage cable (10 units)	30 cm	YS7200A300-S2
	50 cm	YS7200A500-S2
	1 m	YS7200A1000-S2
	2 m	YS7200A2000-S2

Dimensions

(Unit: mm)



*Models with number S7200A□□□-G□□ for gas-fired power burners have only one terminal output and therefore there is no bullet terminal on this side.

FSP136A Analog Flame Meter

The FSP136A analog flame meter is an optimal support tool for maintenance and troubleshooting.
The analog flame meter is used for measuring the flame voltage or flame current of combustion safety equipment.
In addition, the flame current level can be easily recorded by connecting to the recorder jack.

Specifications

●Analog flame meter

Compatible models	AUR300C/350C, AUR450C, RA890F/G, R4750, R4780, FRS100B/C, FRL100/101,.etc
Operating principle	Moving coil
Operating/storage temperature range	0 to 40 °C
Operating/storage humidity range	80% RH max. at 40 °C (no condensation allowed)
Operating direction	Vertical (unit has a strap on top)
Indication accuracy	±2.5 % FS
Recorder output accuracy	
Color	Black
Mass	Approx. 450 g

●Range selection switch

Measurement range differs according to the model to be measured, and analog meter indication differs according to the measurement range. The table below shows the differences.

Range selection switch position	Model to be measured	Analog meter display	Recorder output
OFF	-	No display	-
15UA	R485B*, RA890F/G, R4750C, R4780B/C, R7257A*, R7258A*, R7259B*	Display in the 0-15 μAdc range.	Output in the 0-150 mVdc range.
SPL (special)	R7247B/C, R7476A	Display in the 0-15 μAdc range. If the flame current fluctuates greatly, a smoothed value is displayed.	Output in the 0-150 mVdc range. If the flame current fluctuates greatly, a smoothed value is output.
7.5V	FRL100/101, FRS100B/C, AUR300C/350C, AUR400C/450C,	Display in the 0-7.5 Vdc range.	-

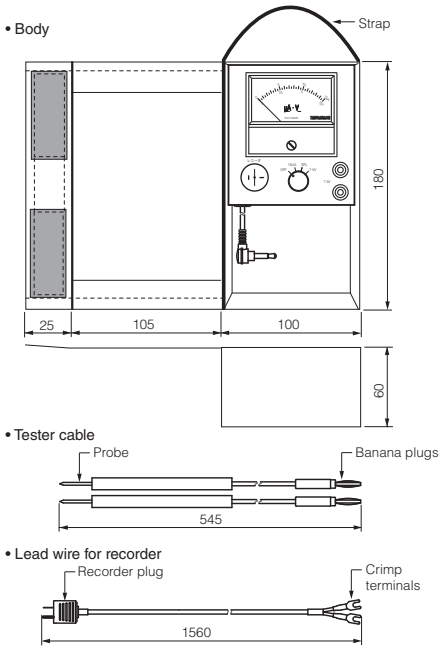
*: discontinued model

Model Selection

Item	Model No.
Analog flame meter	FSP136A100

Dimensions

(Unit: mm)



FSP300C100 Flame Simulator

The flame simulator has the same characteristics as a combustion flame. If problems occur with the combustion safety controller, for example, or when the burner sequence is being checked, the flame simulator can be connected to the flame detection circuit in order to check easily for errors in the flame detector, burner controller, amplifier, external circuits, etc., without actually using a burner.

Specifications

Compatible equipment / Simulator	Combustion safety controller		Flame detector		Method of checking action of flame relay 2K (Caution: Simulator must not touch any point other than those indicated.)	Figure
	Burner controller	Amplifier	Flame rod	Ultraviolet flame detector		
FSP300C100 (black)	RX-R40C	Built-in	-	AUD300C AUD500C	○ Attach the FSP300C100 to the relay terminals and connect lead wires to terminals F, G, S and S. ○ Connect lead wires F and G to RX-R40 terminals B6 (F) and A7 (G), and then connect the S and S lead wires to terminals B9 and A9. ○ Change the FLAME MODE switch on the FSP300C to SYNC.	Fig. 1
	RX-R20C	Built-in	-	AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to RX-R20 terminals B6 (F) and A7 (G). ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 2
	AUR350C AUR300C	Built-in	-	AUD300C AUD500C	○ Attach the FSP300C100 to the AUR350C/300C terminal block (S, S, G, F). ○ Change the FLAME MODE switch on the FSP300C to SYNC.	Fig. 3
	FRS100C	Built-in	-	AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to FRS100C terminals 5 (F) and 6 (G). ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 4
	RA890G	Built-in	-	AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to RA890G terminals F and G. ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 5
	R4150P (discontinued as of Sept. 2003)	R7259B (plug-in type)	-	AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to R4150P terminals F and G. ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 6
	R4750C	Built-in	-	AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to R4750P terminals F and G. ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 7
	R4780C	Built-in		AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to R4780C terminals 23 (F) and 24 (G). ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 8
	WN200A (discontinued as of Dec. 2000) WN210A (discontinued as of Dec. 2000)	R7259B (plug-in type)		AUD110C/100C C7035A C7027A	○ Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G. ○ Connect lead wires F and G to WN200A/210A terminals F1 and G. ○ Change the FLAME MODE switch on the FSP300C to ON.	Fig. 9

Model Selection

Item	Model No.
Flame simulator	FSP300C100

FSP300C100 Flame Simulator

Dimensions

(Unit: mm)

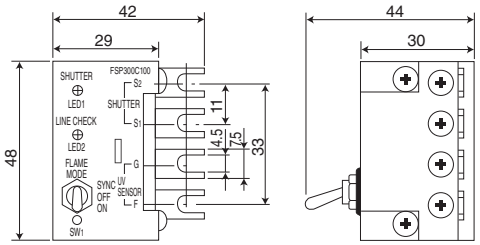
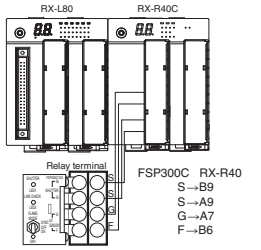
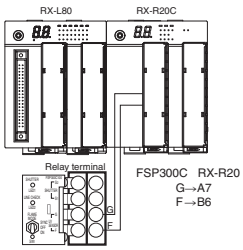


Figure1 FSP300C100-RX-R40C



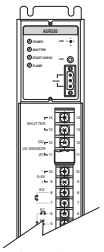
*Attach the FSP300C100 to the relay terminals.

Figure2 FSP300C100-RX-R20C



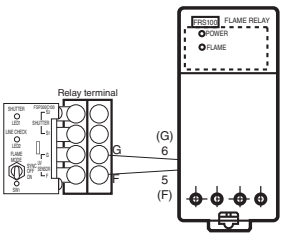
*Attach the FSP300C100 to the relay terminals.

Figure3 FSP300C100-AUR300/350



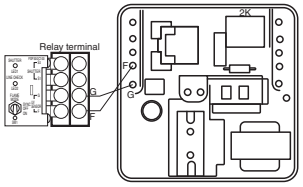
*Attach the FSP300C to terminals 11 through 14.

Figure4 FSP300C100-FRS100C



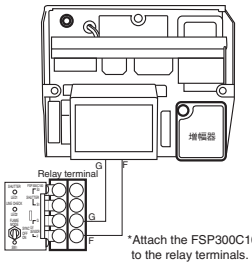
*Attach the FSP300C100 to the relay terminals.

Figure5 FSP300C100-RA890G



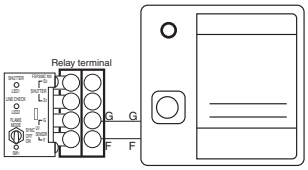
*Attach the FSP300C100 to the relay terminals.

Figure6 FSP300C100-R4150P



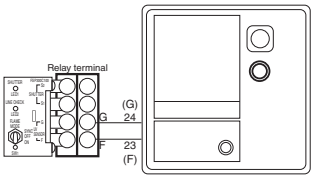
*Attach the FSP300C100 to the relay terminals.

Figure7 FSP300C100-R4750C



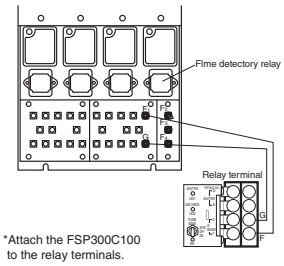
*Attach the FSP300C100 to the relay terminals.

Figure8 FSP300C100-R4780C



*Attach the FSP300C100 to the relay terminals.

Figure9 FSP300C100-WM200A/WN210A



*Attach the FSP300C100 to the relay terminals.

Flame
Safeguard
System

Application Examples (RX Series)

- Selecting an RX Series Combustion Safety Controller
- Boiler
- Deodorizing Furnace
- Small Holding Furnace
- Small Melting and Holding Furnace
- Large Melting Furnace
- Heating Furnace 1 to 4
- Heating Furnace (Regenerative Burner)
- Settings Tables

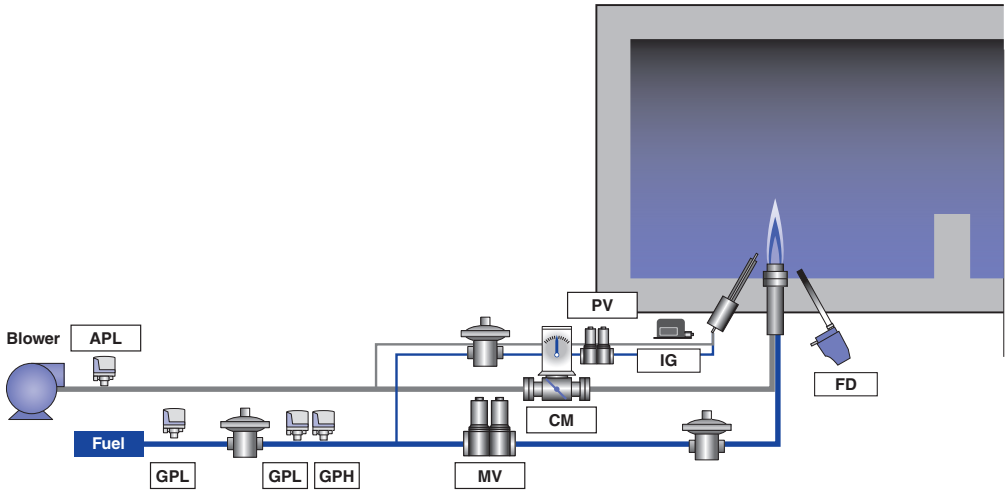
Selecting an RX Series Combustion Safety Controller

Various configurations and specifications exist for combustion equipment depending on the amount of combustion, ignition method, combustion control method, and specific equipment specifications.
The versatile RX Series can be used for a variety of combustion equipment, from small batch furnaces to large-scale steel plant combustion furnaces, and its functions can be easily switched using a PC loader.
To select the appropriate RX Series device, please refer to the pipe trains, sequence charts, or other relevant material in this document.

Single burner

This is a system that controls a single burner using a series of devices such as a blower, combustion gas pressure switch, combustion air pressure switch, and safety shutoff valve.

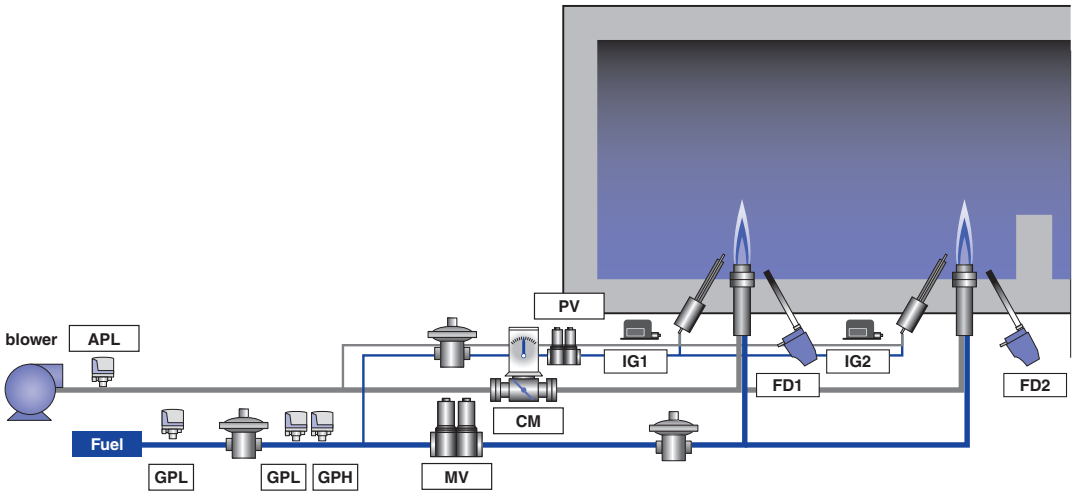
APL : Low air pressure switch
GPL : Low gas pressure switch
GPH : High gas pressure switch
FD : Flame detector
IG : Ignition transformer
PV : Pilot safety shutoff valve
MV : Main safety shutoff valve
CM : Control motor



Multiple burners

This is a facility with many burners in a single combustion furnace. The following diagram shows a multiburner furnace where equipment such as blowers, pressure switches, safety shutoff valves, etc. are shared.
Note: A single facility with multiple combustion furnaces is called a multi-zone facility.

APL : Low air pressure switch
GPL : Low gas pressure switch
GPH : High gas pressure switch
FD : Flame detector
IG : Ignition transformer
PV : Pilot safety shutoff valve
MV : Main safety shutoff valve
CM : Control motor



Method of controlling combustion amount

● ON/OFF control

The amount of combustion is controlled by igniting and extinguishing the burner. This method is frequently adopted by small combustion furnaces, and the combustion furnace equipment configuration can be made quite simple.
Also, the time-proportional ON/OFF control method uses repeated short intervals of combustion in order to reach the desired amount of heat. In this case, it is necessary to periodically inspect and replace equipment in consideration of the service life of the safety shutoff valve and control device.
(Models RX-R22/46 allow driving of the load and ensuring of safety by using the RX-R external relay. These models make highly frequent ON/OFF control possible without relying on the service life of the RX Series internal relay.)

● Hi-Lo-Off Control

The amount of combustion is controlled in small increments by ON/OFF control. This is used in small to medium sized combustion furnaces.

● Proportional control

Proportional control is able to continuously control the amount of combustion and is widely adopted in combustion furnaces that require exact control of the combustion process. This is generally used in large combustion furnaces to continuously maintain a desired amount of combustion between minimum and maximum. However, this method requires a variety of equipment, such as control motors, equalizing valves, etc., which makes its configuration and adjustment complicated in comparison to ON/OFF control.

Synchronous and asynchronous ignition

Synchronous ignition is when multiple burners are ignited in sync (simultaneously) in a multi-burner setup. Because multiple burners share safety shutoff valves, the configuration can be made simpler by reduction of the number of safety shutoff valves. However, if there is a flame failure in one burner, then multiple burners must be shut off because the safety shutoff valve is shared.
Asynchronous ignition is when multiple burners are ignited asynchronously (at different times) in a multi-burner system. Because safety shutoff valves are not shared, if there is a flame failure in one burner, the burner's gas supply can be shut off without affecting other burners. Also, since burners are individually ignited and extinguished, thinned-out operation and the stopping of burners when a malfunction occurs is possible.

Application Examples

● Single burner

No.	Ignition method	Control method	Main combustion facility	Reference page	Setup
	Pilot				
1	Interrupted pilot	Proportional control	Boiler	pages 40 and 41	page 60
2	Interrupted pilot	Proportional control	Deodorizing furnace	pages 42 and 43	page 60
3	Continuous pilot	ON/OFF	Small holding furnace	pages 44 and 45	pages 62 and 63

● Multiple burners

No.	Ignition method		Control method	Main combustion facility	Reference page	Setup
	Burner	Pilot				
1	Asynchronous ignition	Interrupted pilot	Hi-Lo-OFF	Small melting holding furnace	pages 46 and 47	pages 62 and 63
2	Asynchronous ignition	Direct ignition	ON/OFF (time proportional)	Large melting furnace	pages 48 and 49	pages 64 and 65
3	Asynchronous ignition	Interrupted pilot	Proportional control	Heating furnace 1	pages 50 and 51	pages 64 and 65
4	Asynchronous ignition	Continuous pilot	Proportional control	Heating furnace 2	pages 52 and 53	pages 66 and 67
5	Asynchronous ignition	Continuous pilot	ON/OFF (time proportional)	Heating furnace 3	pages 54 and 55	pages 66 and 67
6	Asynchronous ignition	Direct ignition	ON/OFF (time proportional)	Heating furnace 4	pages 56 and 57	pages 68 and 69
7	Asynchronous ignition	Continuous pilot	ON/OFF (time proportional)	Heating furnace (regenerative burner)	pages 58 and 59	pages 68 and 69

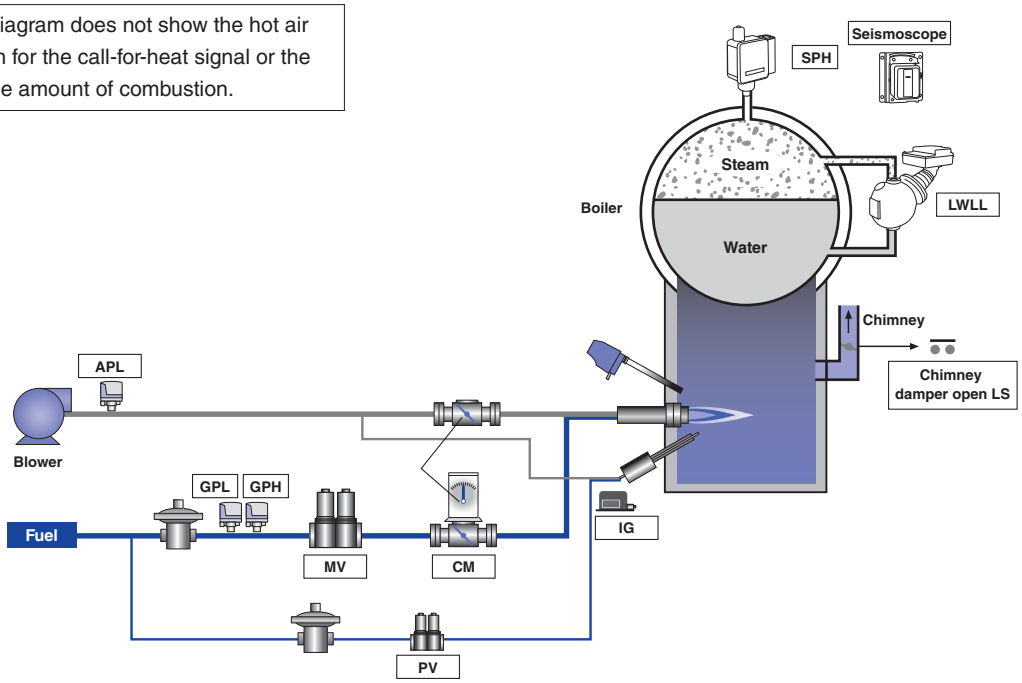
Boiler

Pipe train

Single burner: Interrupted pilot ignition - Proportional control

- When the RX-L start signal turns on and the steam pressure switch for the boiler call-for-heat signal turns ON, the prepurge begins. The prepurge is a proven prepurge which sets the combustible air content to the maximum combustion position and then, when that ends, moves to the minimum combustion position before finishing.
  Burner ignition is a low fire ignition, and after the main burner has ignited, control of the amount of combustion is started by a signal from the pressure controller.
- Between when the burner starts and the pilot burner ignites, whether the main safety shutoff valve is closed is an interlock condition.
- When the boiler load decreases and the boiler pressure rises, the hot air pressure switch for the call-for-heat signal turns OFF, burner combustion stops, and the postpurge begins. When the postpurge ends, the burner stops and enters standby mode.

Caution: The following diagram does not show the hot air pressure switch for the call-for-heat signal or the controller for the amount of combustion.

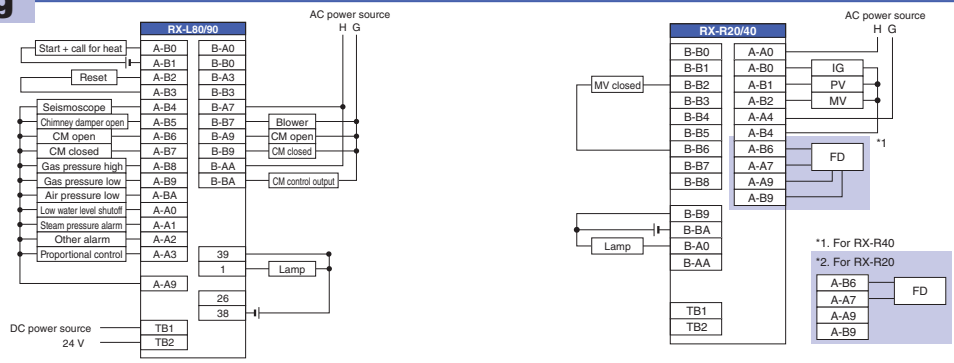


Seismoscope: Seismic sensor
APL: Low air pressure switch
GPL: Low gas pressure switch
GPH: High gas pressure switch
LWLL: Low water level shutoff
SPH: High steam pressure switch
FD: Flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: Main safety shutoff valve
CM: Control motor

RX configuration

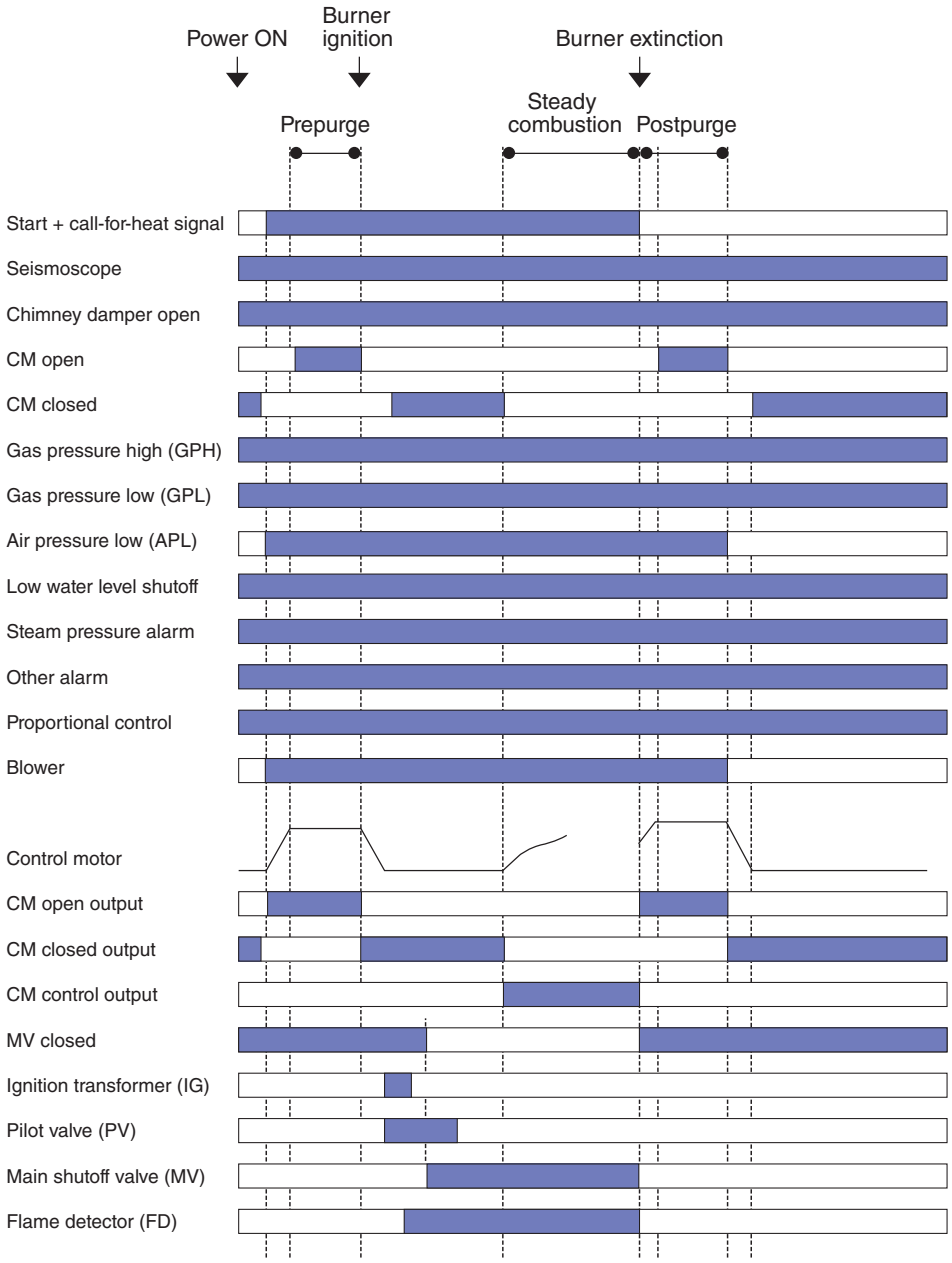
RX-L80 /90	RX-R20 /40

Wiring



●Please refer to page 60 for the settings table.

Sequence chart

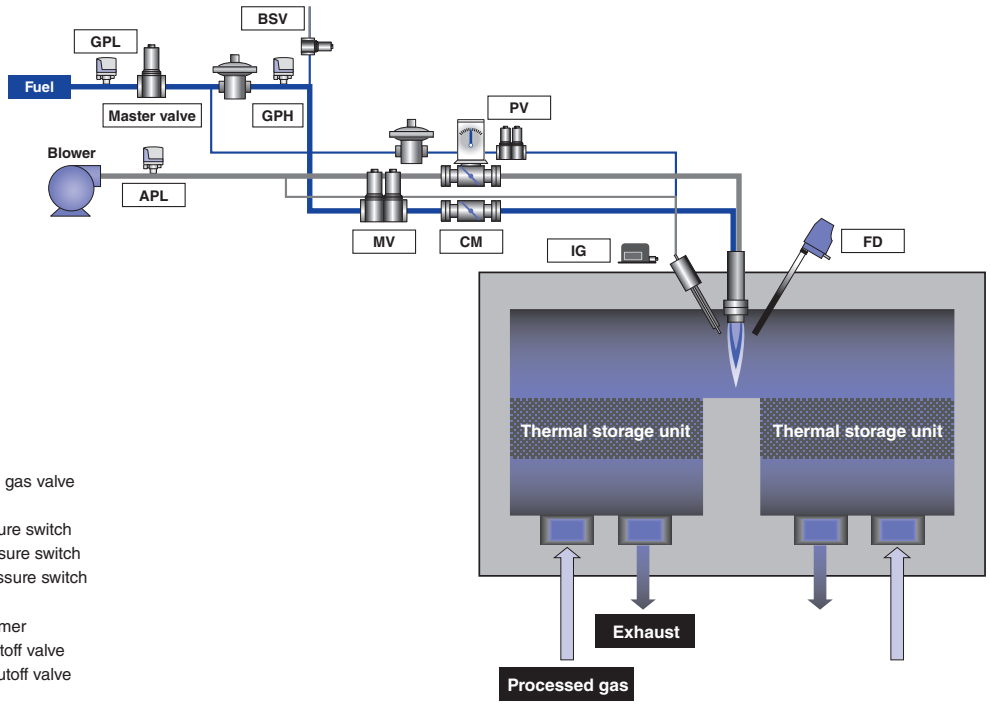


Deodorizing Furnace

Piping train

Single burner: Interrupted pilot ignition - Proportional control

- The burner is in sync with operation of the furnace, but the input route of the processed gas switches over at a certain period of time and waste heat is recovered.
- The changeover valve for processed gas and exhaust is operated by an external control circuit.
- The main gas valve and vent valve activate once the prepurge is completed and the RX-R starts at the same time. (If the main gas valve is the slow-open type, the RX side start delay time (2-4) is set for the amount of time the main gas valve is confirmed to be open in order to handle the delay in starting the ignition.)
  At this time, the main gas valve open answer is set as the interlock condition after the prepurge is completed.

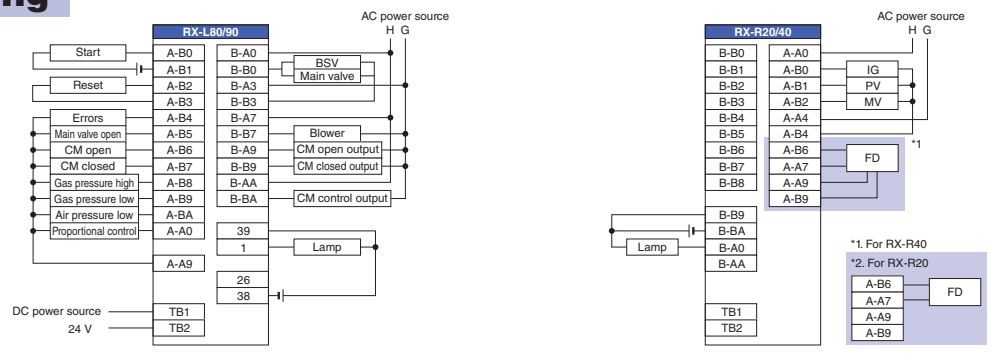


Master valve: Main gas valve
BSV: Vent valve
APL: Low air pressure switch
GPL: Low gas pressure switch
GPH: High gas pressure switch
FD: Flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: Main safety shutoff valve
CM: Control motor

RX configuration

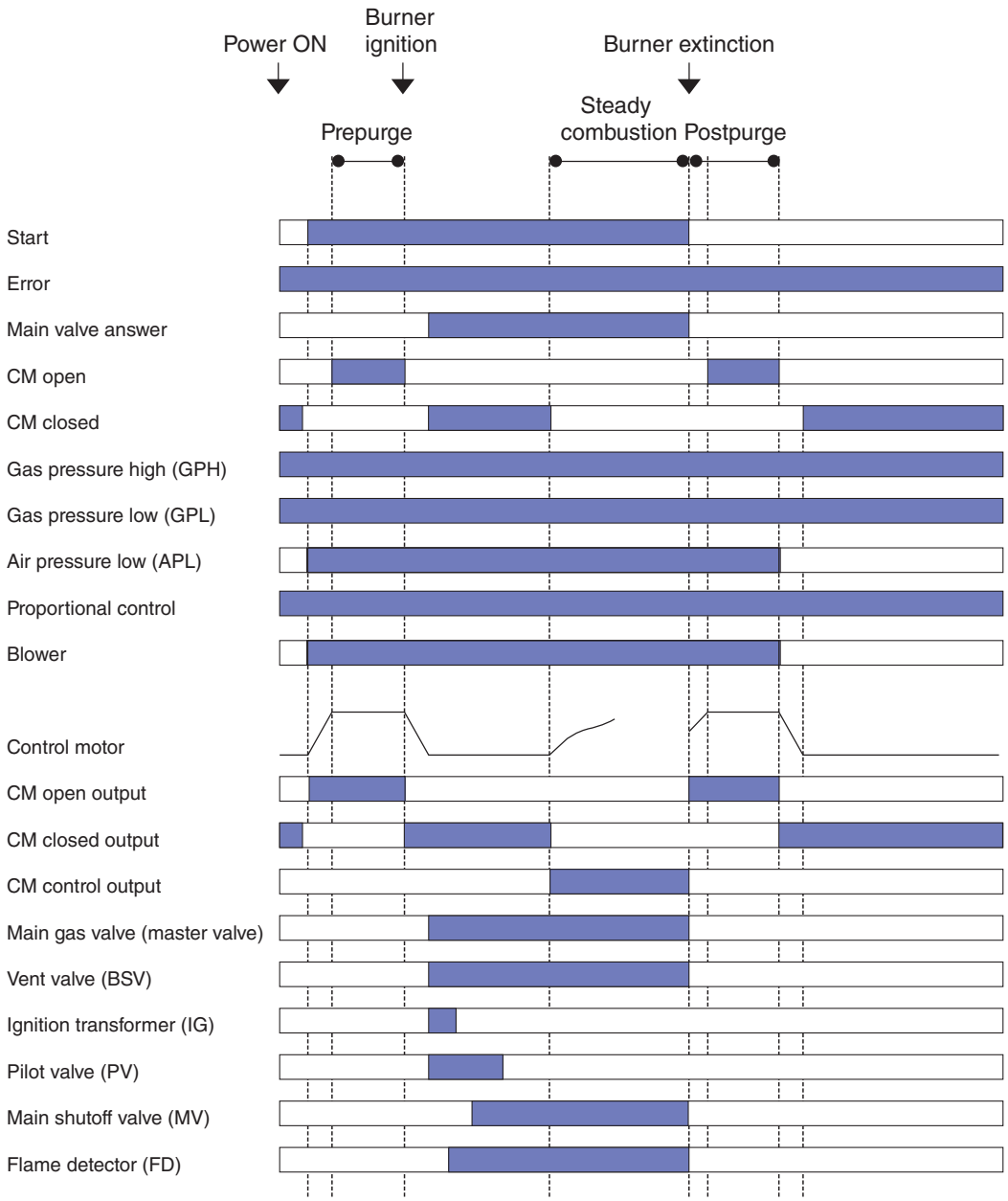
RX-L80 /90	RX-R20 /40

Wiring



Please refer to page 60 for the settings table.

Sequence chart

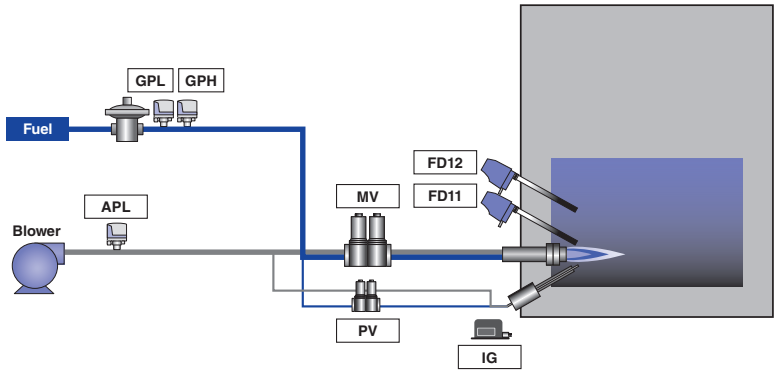


Small Holding Furnace

Piping train

Single burner: Continuous pilot ignition - ON/OFF control

- The burner is in sync with operation of the furnace. After the RX-L has started, when the prepurge has completed the burner operates automatically until the pilot ignition activates.
- The call for-heat is reflected in the RX-R main burner ignition command and the main burner engages.
- Once the call-for-heat ends the main burner ignition command is turned OFF and the main burner stops.
- The pilot burner operates as normal with no relation to the call for heat, and in this case it is necessary to monitor both the pilot burner and main burner flame individually.

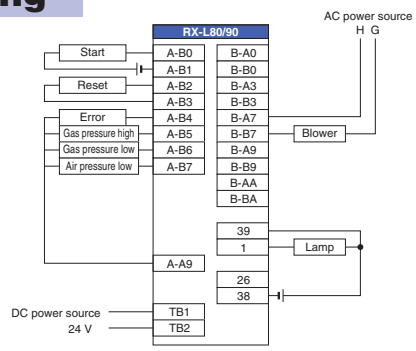


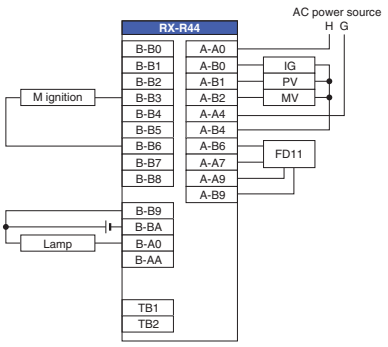
APL: Low air pressure switch
GPL: Low gas pressure switch
GPH: High gas pressure switch
FD11: Pilot burner flame detector
FD12: Main burner flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: Main safety shutoff valve

RX configuration

RX-L80 /90	RX-R44	RX-R40

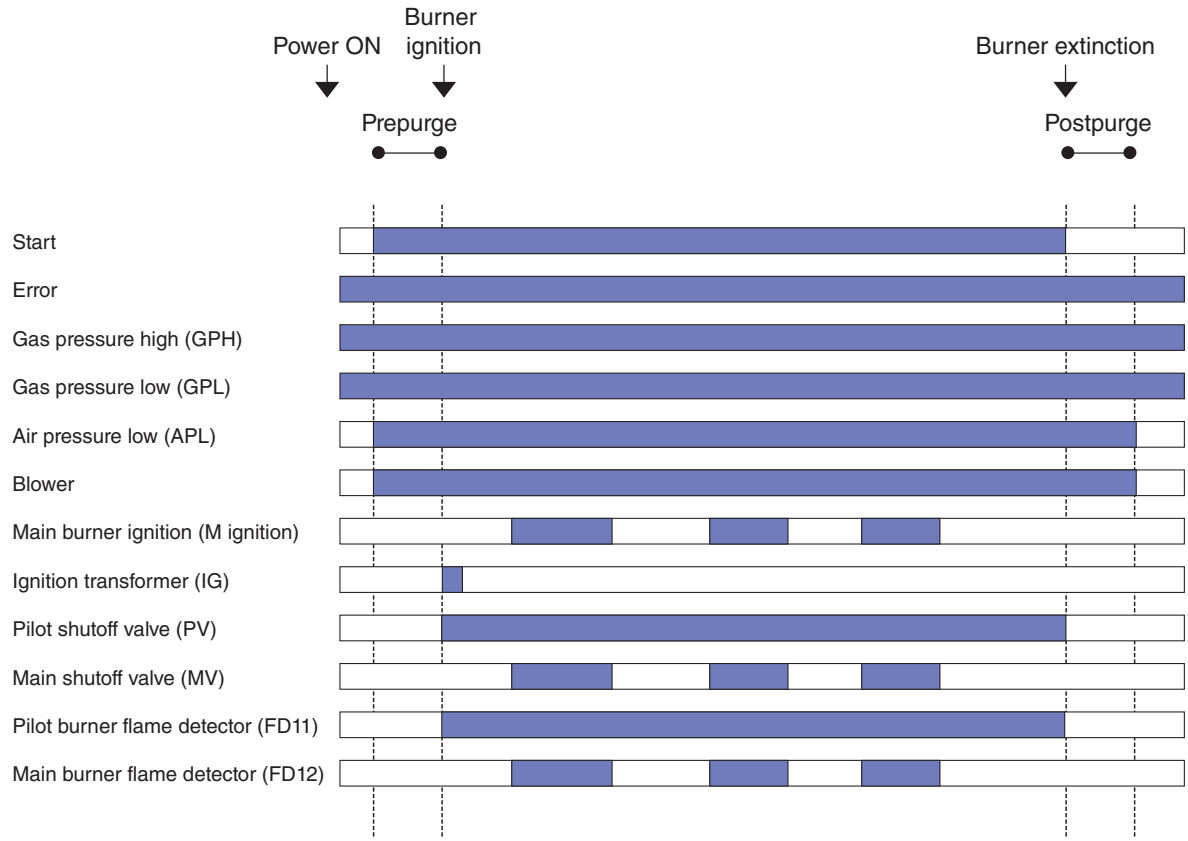
Wiring

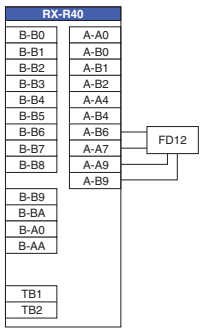




●Please refer to pages 62 and 63 for the settings table.

Sequence chart





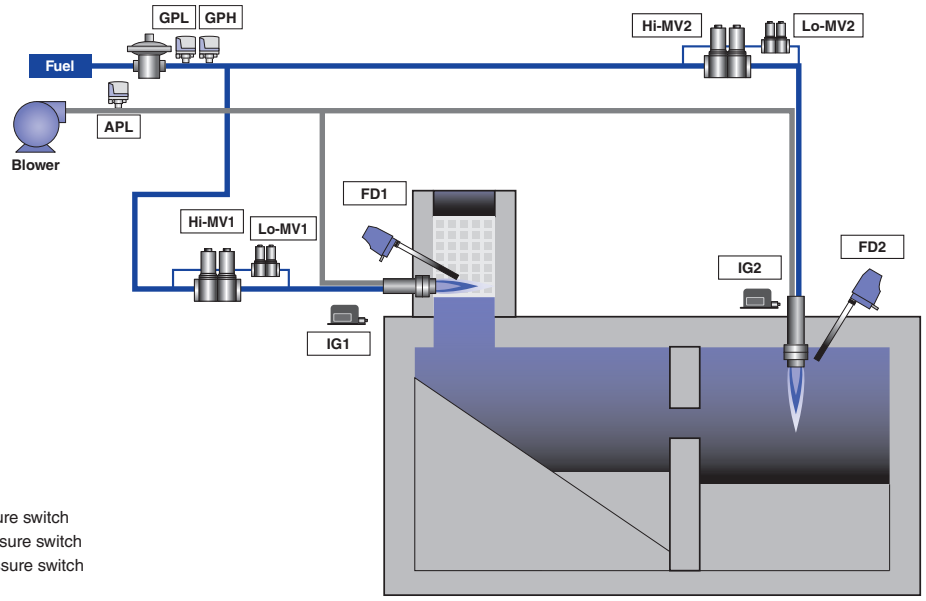
M ignition: Main burner ignition

Small Melting and Holding Furnace

Piping train

Multiple burners: Interrupted pilot ignition - Hi/Lo control

- When the furnace begins operation and after the RX-L starts, the RX-L prepurge will start when there is a start request (low fire burner ignition) at either of the RX-Rs.
- The burner, activated by a low fire ignition command, operates automatically until the ignition of the pilot burner. Afterwards, a request for high fire ignition is input and high fire combustion begins.
- When both a low fire ignition and high fire ignition are input simultaneously, the Hi combustion will activate after the Lo combustion has finished and the Lo confirmation time has ended.

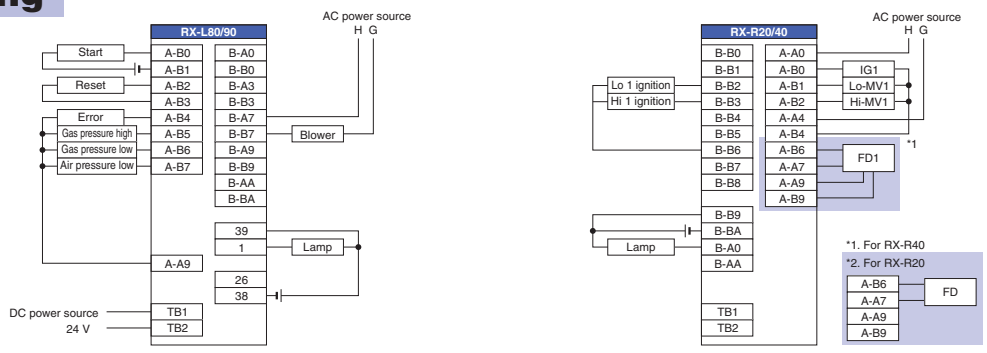


APL: Low air pressure switch
GPL: High gas pressure switch
GPH: High gas pressure switch
FD: Flame detector
IG: Ignition transformer
Lo-MV: Low fire shutoff valve
Hi-MV: High fire shutoff valve

RX configuration

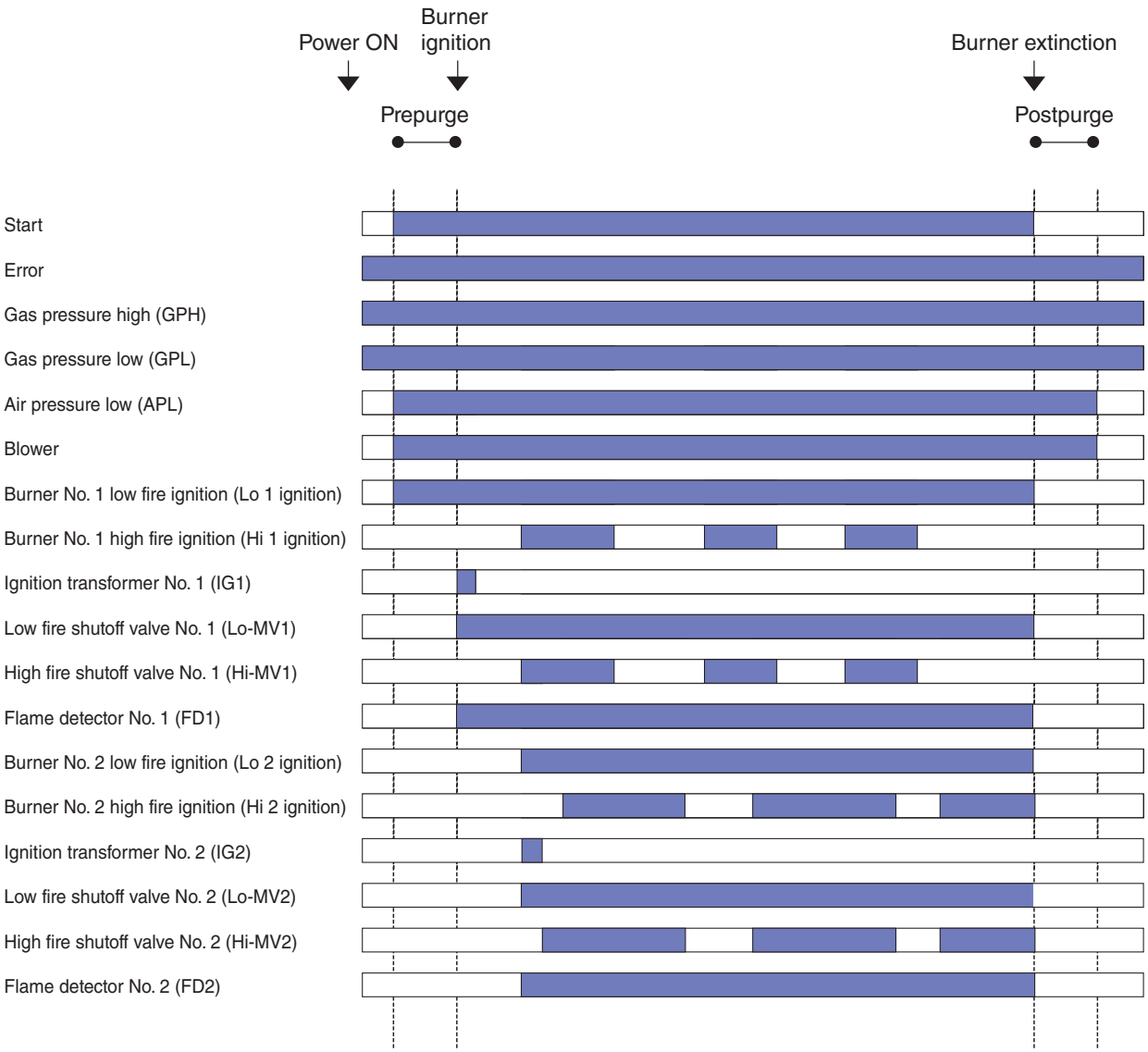
RX-L80 /90	RX-R20 /40	RX-R20 /40

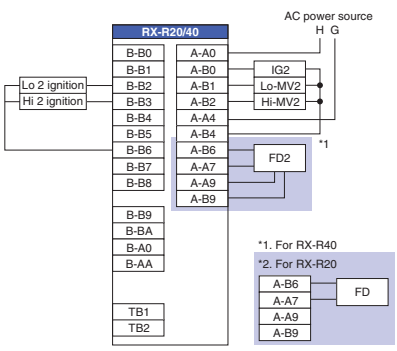
Wiring



●Please refer to pages 62 and 63 for the settings table.

Sequence chart


Power ON
Burner ignition
Burner extinction
Prepurge
Postpurge
Start
Error
Gas pressure high (GPH)
Gas pressure low (GPL)
Air pressure low (APL)
Blower
Burner No. 1 low fire ignition (Lo 1 ignition)
Burner No. 1 high fire ignition (Hi 1 ignition)
Ignition transformer No. 1 (IG1)
Low fire shutoff valve No. 1 (Lo-MV1)
High fire shutoff valve No. 1 (Hi-MV1)
Flame detector No. 1 (FD1)
Burner No. 2 low fire ignition (Lo 2 ignition)
Burner No. 2 high fire ignition (Hi 2 ignition)
Ignition transformer No. 2 (IG2)
Low fire shutoff valve No. 2 (Lo-MV2)
High fire shutoff valve No. 2 (Hi-MV2)
Flame detector No. 2 (FD2)



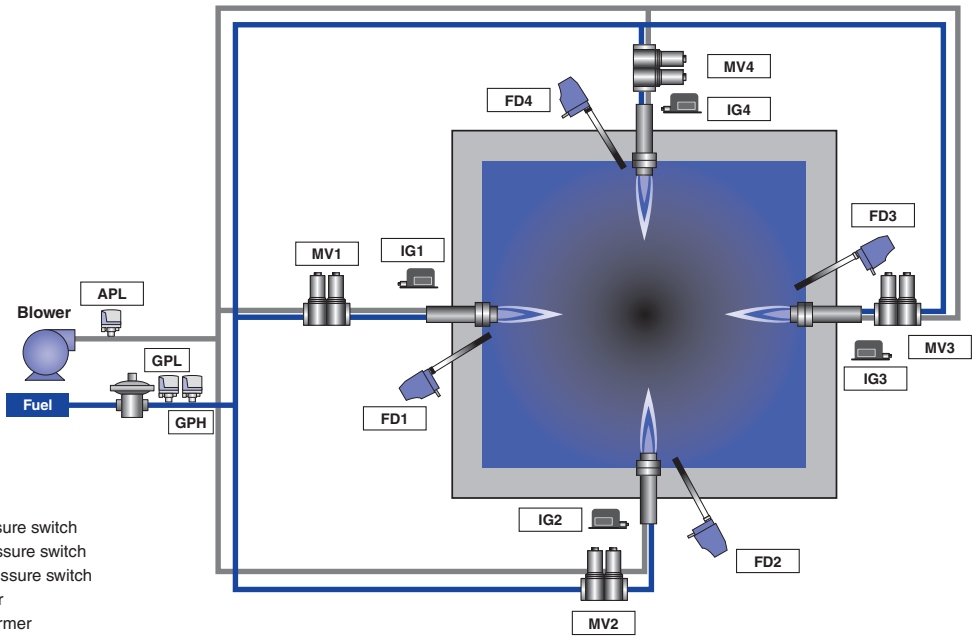
Lo * ignition: Low fire ignition of burner No. "*"
Hi * ignition: High fire ignition of burner No. "*"

Large Melting Furnace

Piping train

Multiple burners: Direct ignition - Time proportional control

- When the furnace begins operation and after the RX-L starts, the RX-L prepurge will start at the first RX-R start request (ignition command).
- If all of the start requests (ignition commands) end for all RX-Rs and the next call-for-heat (ignition command) is within the allowable time, then the furnace can restart with a prepurge.
  Whether or not a prepurge is implemented depends on the prepurge conditions (B-12) at the RX-L restart time and cancellation within the allotted time. The allowable time is managed by the recognition wait time (D-8). If the allowable time is exceeded, the furnace will be restarted with a prepurge.
- A direct ignition model is incorporated because the number of times the burners start and stop increases.

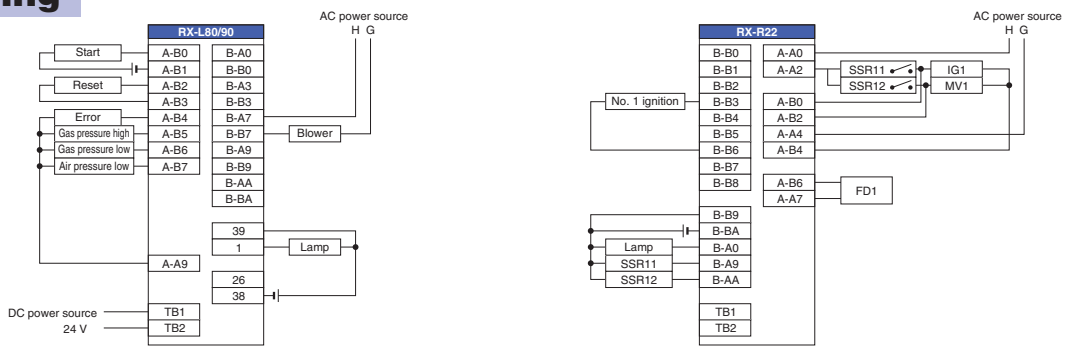


APL: Low air pressure switch
GPL: Low gas pressure switch
GPH: High gas pressure switch
FD: Flame detector
IG: Ignition transformer
MV: Main shutoff valve

RX configuration

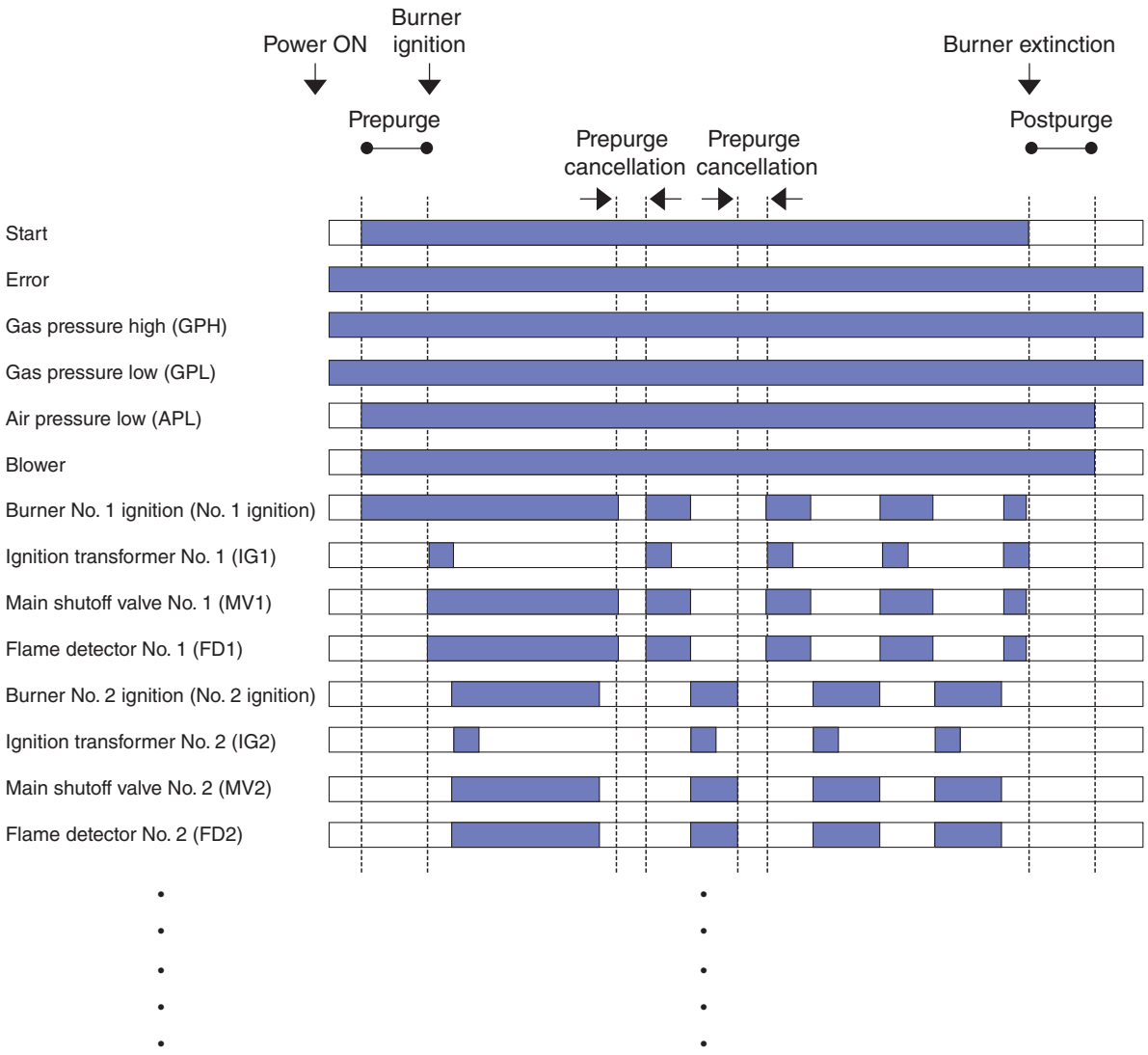
RX-L80 /90	RX-R22	RX-R22	RX-R22	RX-R22

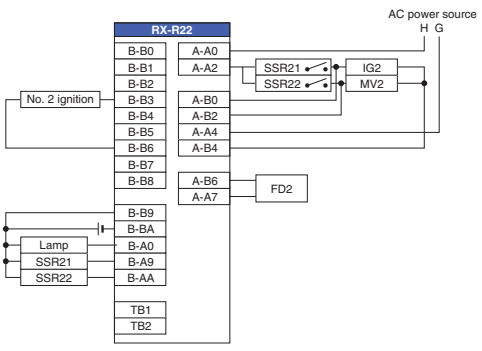
Wiring



- Please refer to pages 64 and 65 for the settings table.

Sequence chart





• • • • • (No.3, No.4)

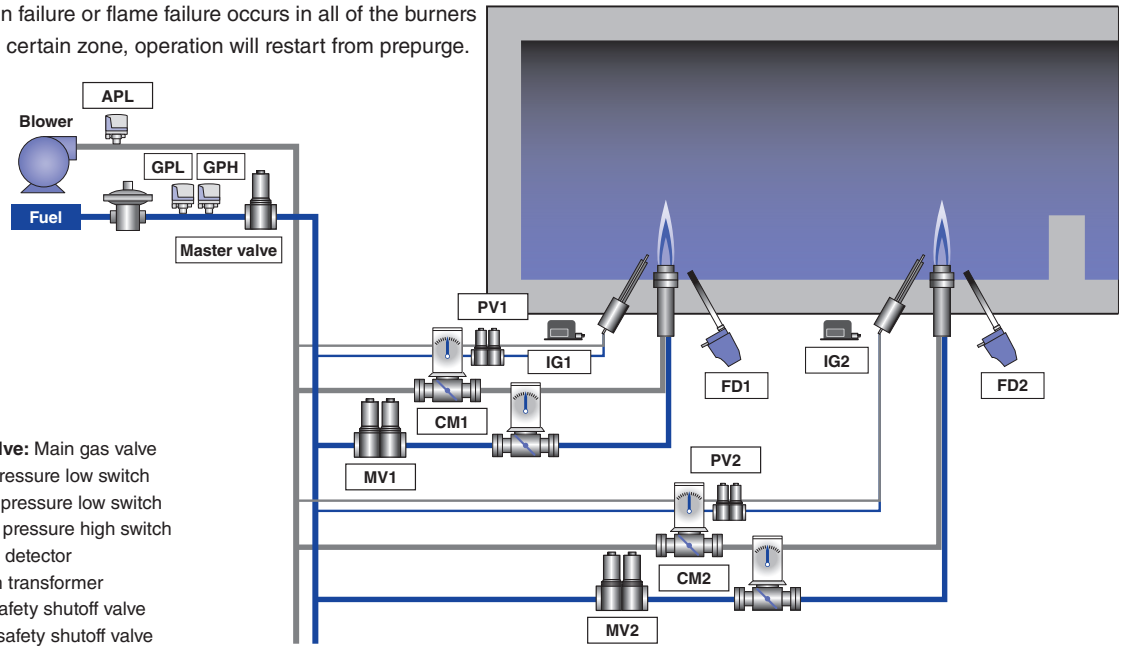
No. * ignition: Ignition of burner No. "*"
SSR: Solid state relay

Heating Furnace 1

Piping train

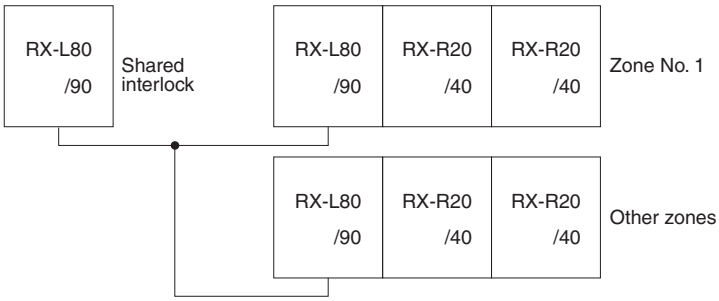
Multiple burners: Interrupted pilot ignition - Proportional control

- The blower, control valve and main gas valve are driven by the external control circuit. The Hi/Lo position of each control valve is input into the zone RX-L and monitoring of the control valve opening is performed during the purge and ignition process. (Note: The CM1 and CM2 control motors are controlled by a connected host device.)
- If there is an ignition failure or flame failure, only the affected burner will be stopped, and it will restart by an ignition command from the RX-R once the operation has been reset.
- When restarting a burner that has accidentally gone out, the CM1 and CM2 control valves must be closed when igniting and confirmation of closure must be received.
- If ignition failure or flame failure occurs in all of the burners within a certain zone, operation will restart from prepurge.

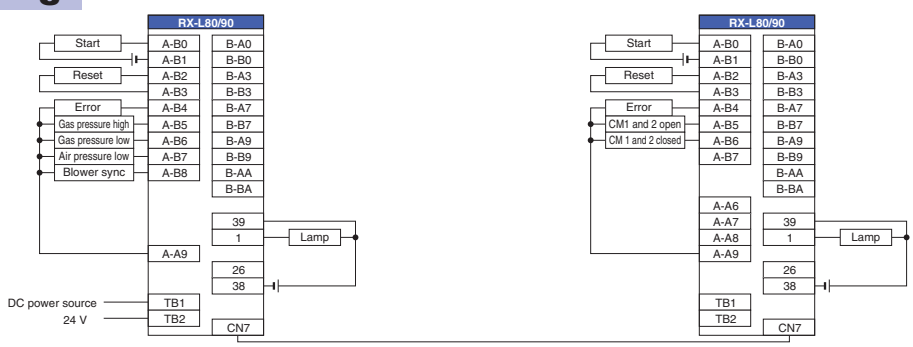


Master valve: Main gas valve
APL: Air pressure low switch
GPL: Gas pressure low switch
GPH: Gas pressure high switch
FD: Flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: Main safety shutoff valve
CM: Control motor

RX configuration

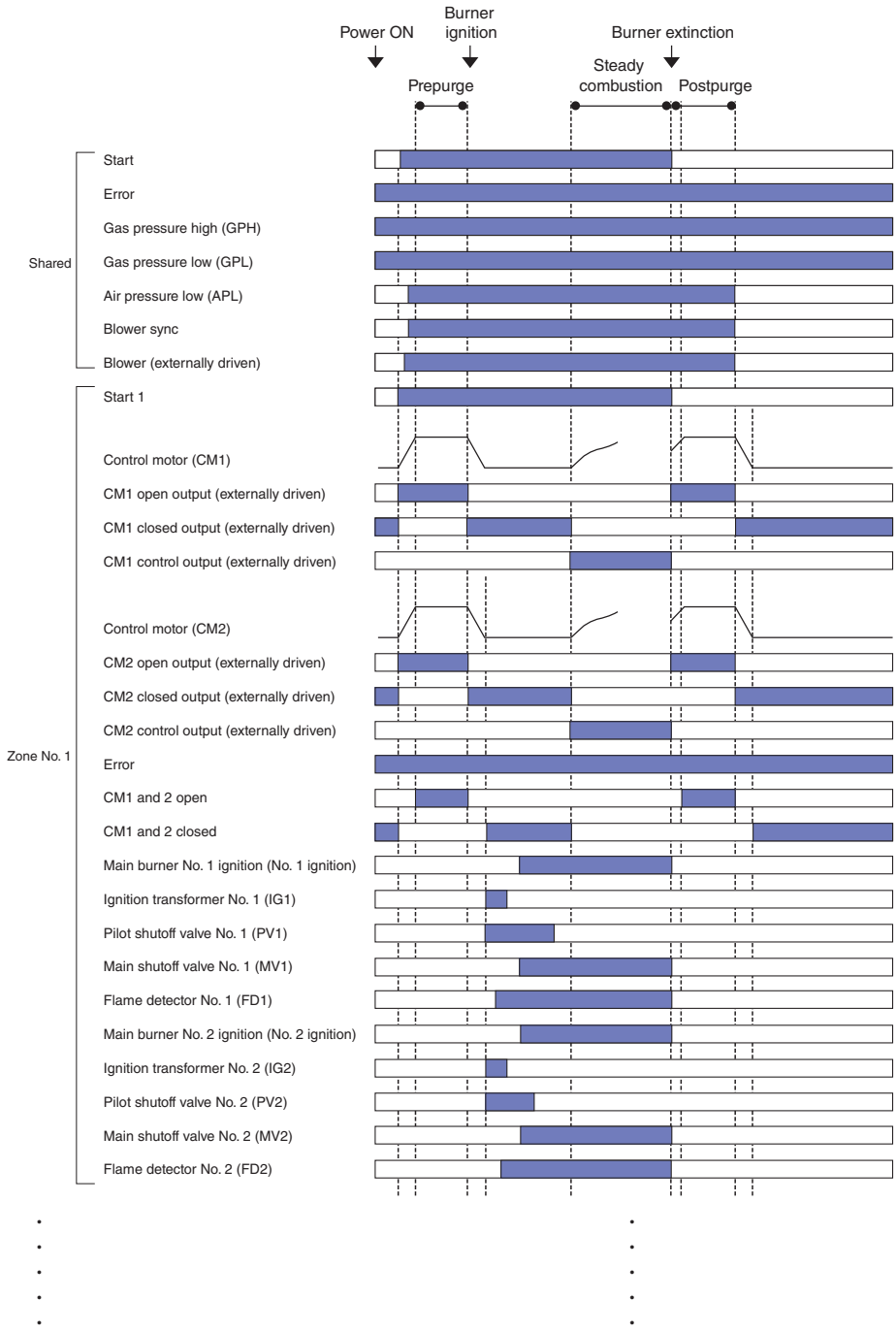


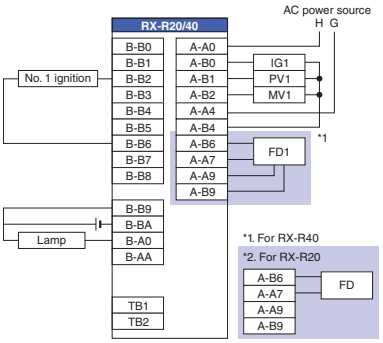
Wiring

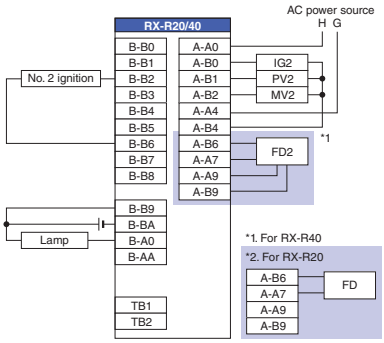


Please refer to pages 64 and 65 for the settings table.

Sequence chart







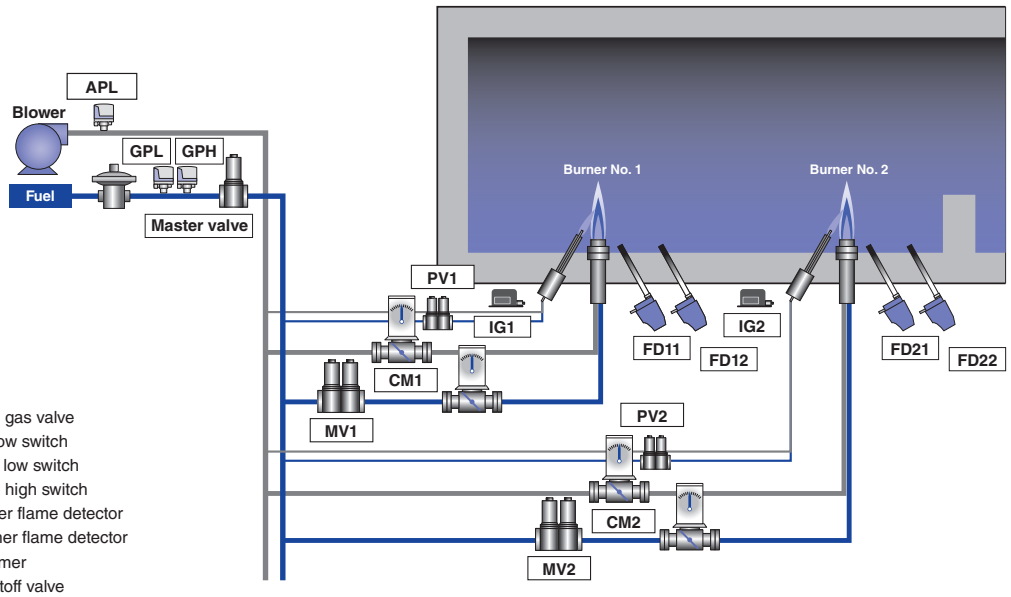
No. * ignition: Ignition of main burner No. "*"

Heating Furnace 2

Piping train

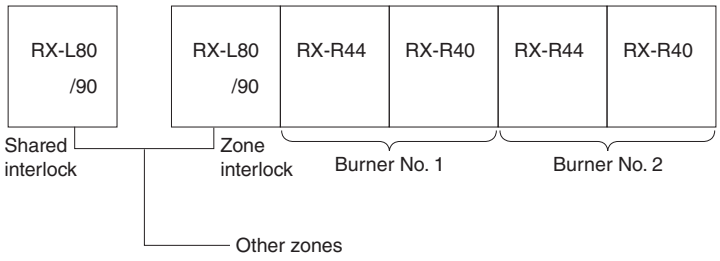
Multiple burners: Continuous pilot ignition - Proportional control

- The blower, control valve and main gas valve are driven by an external control circuit. The Hi/Lo position of each control valve is input into the zone RX-L and monitoring of the control valve opening is performed during the purge and ignition process. (Note: The CM1 and CM2 control motors are controlled by a connected host device.)
- If there is an ignition failure or flame failure, only the affected burner will be stopped, and it will restart by an ignition command from the RX-R once the operation has been reset.
- When restarting a burner that has accidentally gone out, the CM1 and CM2 control valves must be closed when igniting and confirmation of closure must be received.
- If there is an ignition failure or flame failure of all of the burners within a certain zone, operation will restart from prepurge.

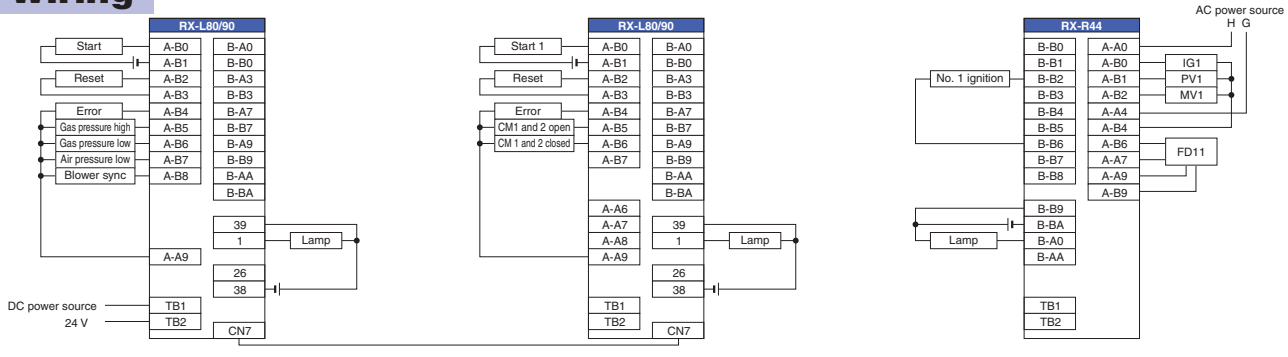


Master valve: Main gas valve
APL: Air pressure low switch
GPL: Gas pressure low switch
GPH: Gas pressure high switch
FD11/21: Pilot burner flame detector
FD12/22: Main burner flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: Main safety shutoff valve
CM: Control motor

RX configuration

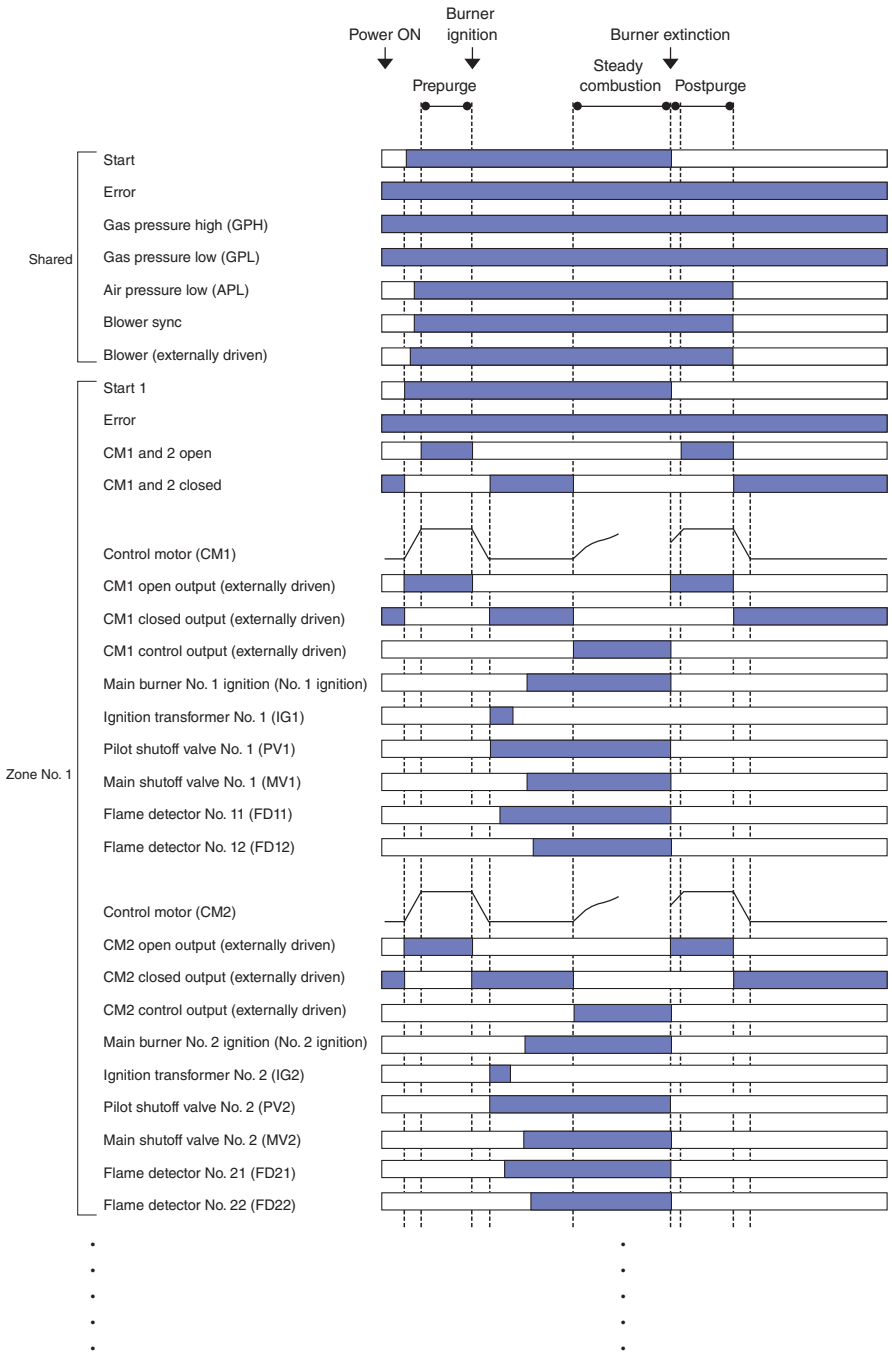


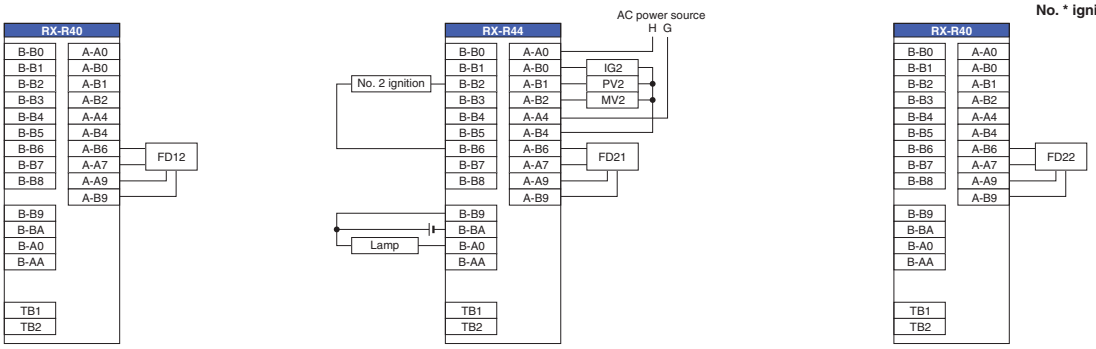
Wiring



●Please see pages 66 and 67 for the settings table.

Sequence chart





No. * ignition: Ignition of main burner No. "*"

Heating Furnace 3

Piping train

Multiple burners: Continuous pilot ignition - Time proportional control (individual ignition)

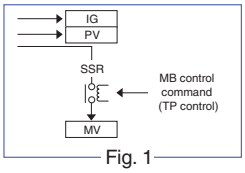
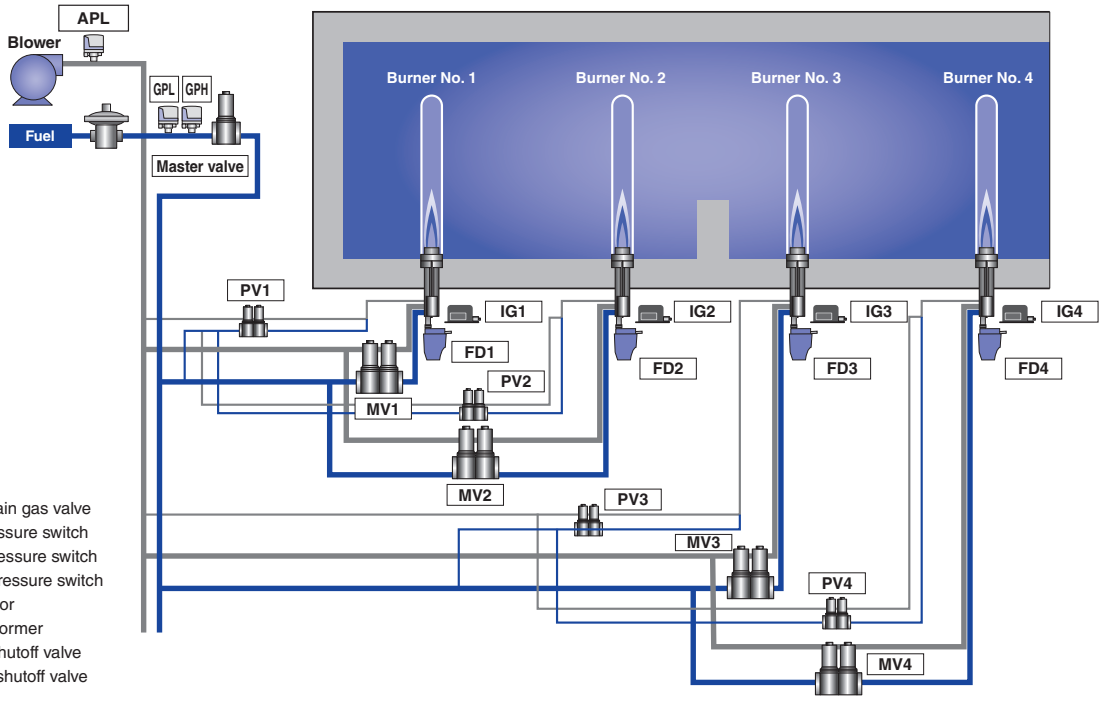


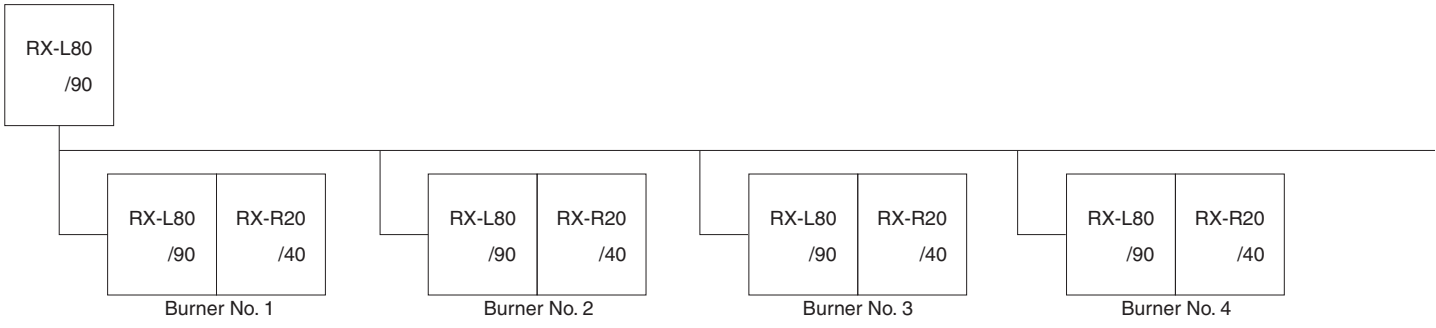
Fig. 1

- The blower and main gas valve are driven by an external control circuit.
- The burners are started by individual RX-Ls. When the RX-L of each burner starts, they proceed to the prepurge and then pilot ignition.
  The main burner ignition for each zone is input according to the call-for-heat and the main burner is activated.
  If the activation frequency of the main burner is taken into account, a circuit controlled externally is added (see fig. on the right).
- If there is an ignition failure or flame failure, only the affected burner will be stopped, and after the operation is reset, the burner will be restarted from prepurge by reentry of the RX-L start command.

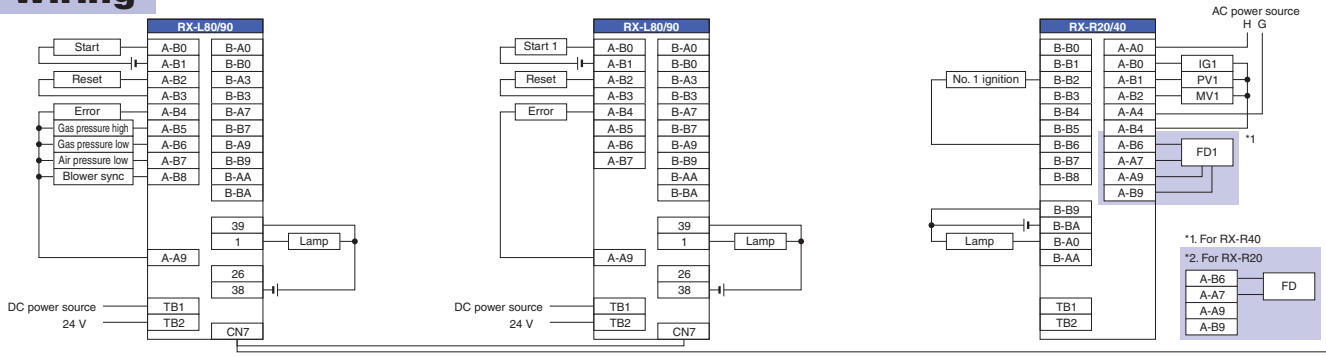


Master valve: Main gas valve
APL: Low air pressure switch
GPL: Low gas pressure switch
GPH: High gas pressure switch
FD: Flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: main safety shutoff valve

RX configuration

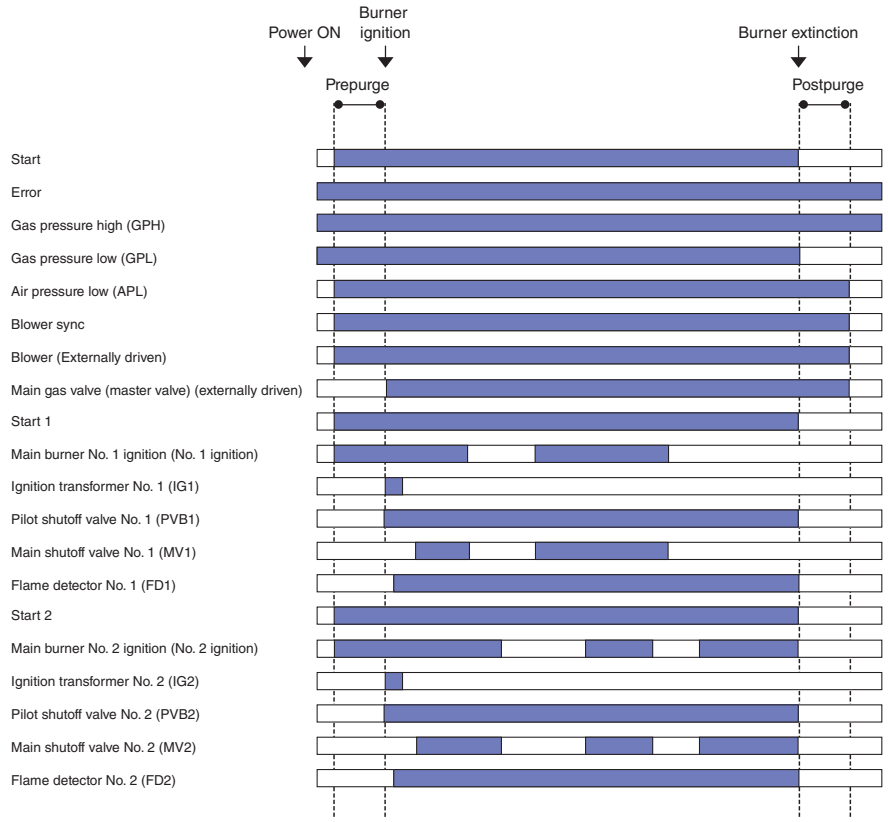


Wiring

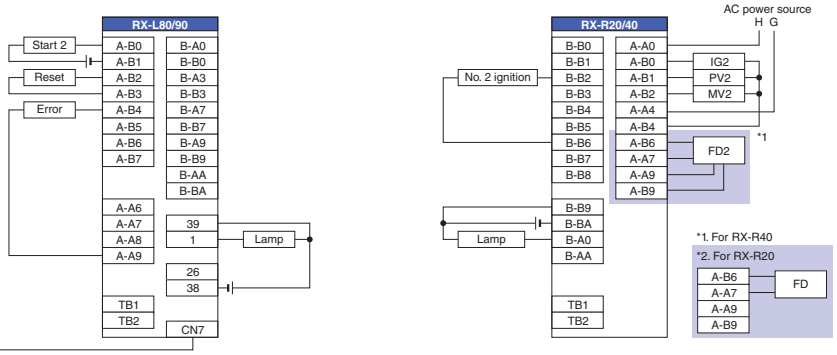


●Please refer to pages 66 and 67 for the settings tables.

Sequence chart



Burner No.*



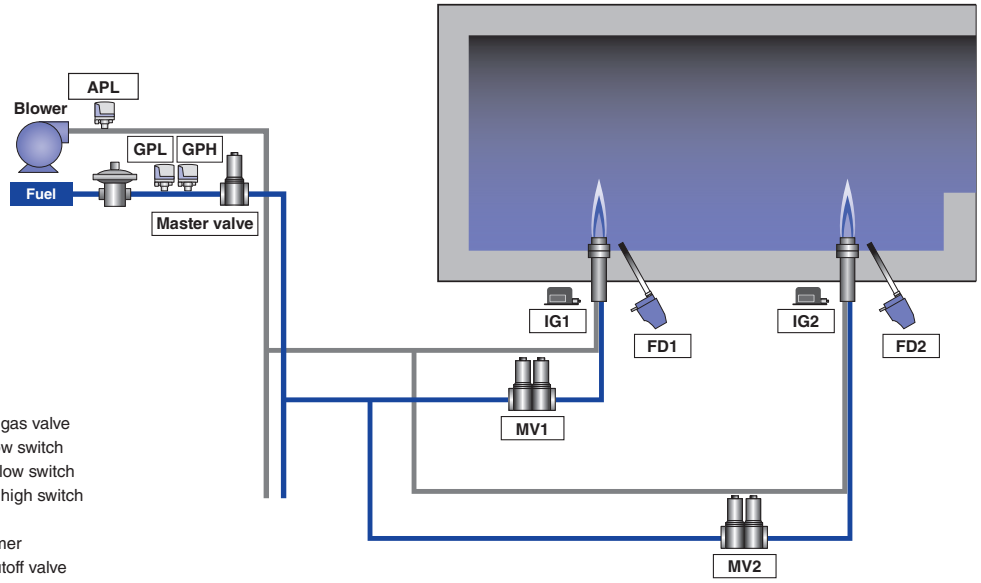
No. *: Ignition of main burner No. "*"

Heating Furnace 4

Piping train

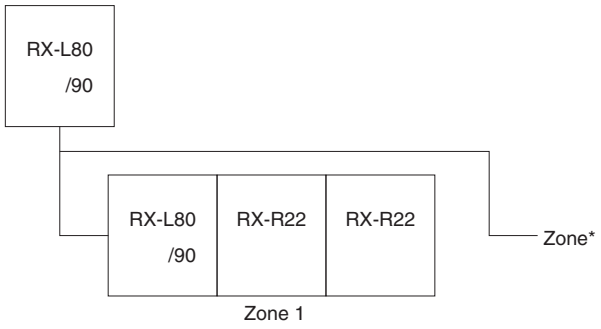
Multiple burners: Continuous direct ignition - Time proportional control

- The blower and main gas valve are driven by an external control circuit.
- After the RX-L is started one of the RX-Rs starts, and operation proceeds through prepurge, pilot ignition and main ignition.
- If there is an ignition failure or flame failure, only the affected burner will be stopped, and it will be restarted by an ignition command from the RX-R once the operation has been reset.
- If all of the burners within a certain zone experience ignition failure or flame failure, the operation will restart from prepurge.
- If all of the start requests (ignition commands) end for all RX-Rs and the next call-for-heat (ignition command) is within the allowable time, then the furnace can restart with a prepurge.
  Whether or not a prepurge is implemented depends on the prepurge conditions (B-12) at the RX-L restart time and cancellation within the allotted time. The allowable time is managed by the reignition wait time (D-8). If the allowable time is exceeded, the furnace will be restarted with a prepurge.
- A direct ignition model is incorporated because the number of times the burners start and stop increases.

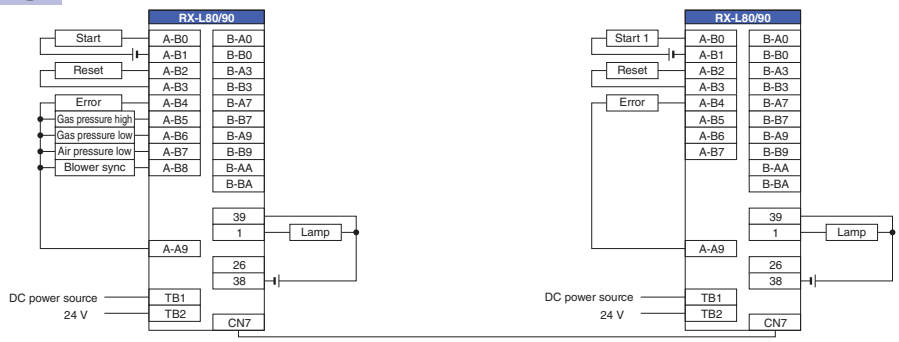


Master valve: Main gas valve
APL: Air pressure low switch
GPL: Gas pressure low switch
GPH: Gas pressure high switch
FD: Flame detector
IG: Ignition transformer
MV: Main safety shutoff valve

RX configuration

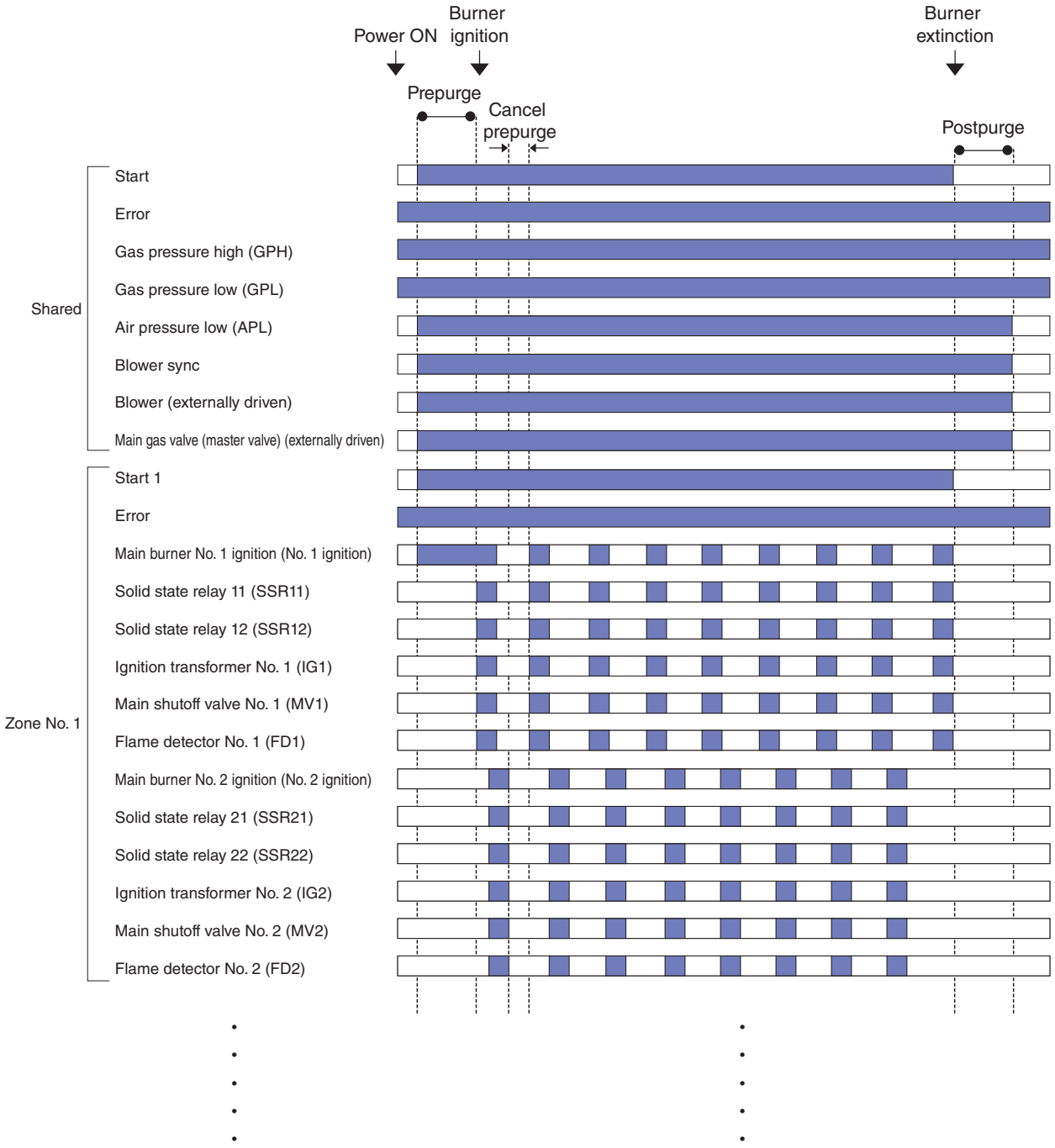


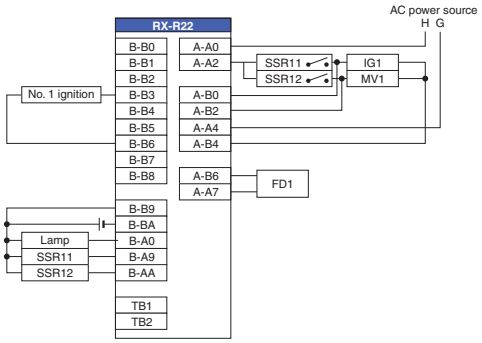
Wiring

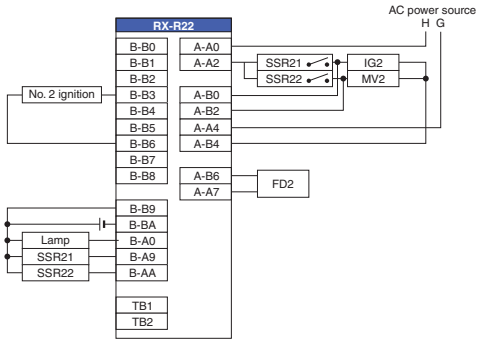


●Please see pages 68 and 69 for the settings table.

Sequence chart







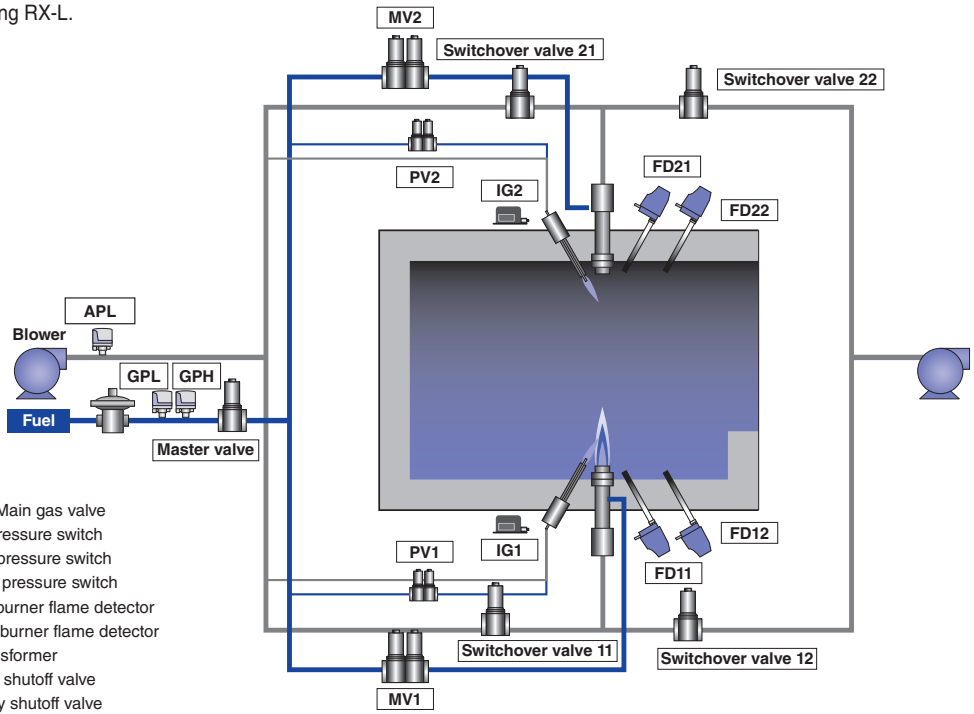
No. * ignition: Ignition of main burner No. "*"
SSR: Solid state relay

Heating Furnace (Regenerative Burner)

Piping train

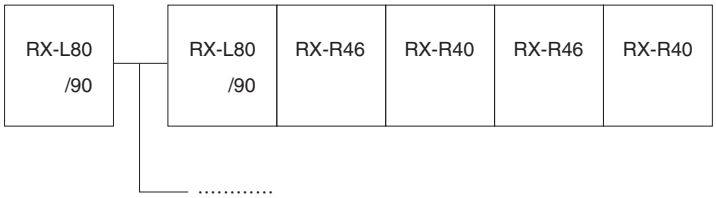
Multiple burners: Continuous pilot ignition - Time proportional control

- The blower and main gas valve are driven by an external control circuit.
- Each pair of burners is started by the RX-L.
  The pilot burners are activated once the RX-L is started, the main burner ignition for each RX-R is input according to the main request which activates the main burner.
  An externally controlled circuit is added because the burner is more frequently activated.
- When an ignition failure or flame failure occurs, the pair is stopped, and after it is reset, it restarts operation once the RX-L ignition command is given.
- The air supply and exhaust switchover valve are controlled by an external circuit, but the necessary interlock information is monitored by the corresponding RX-L.

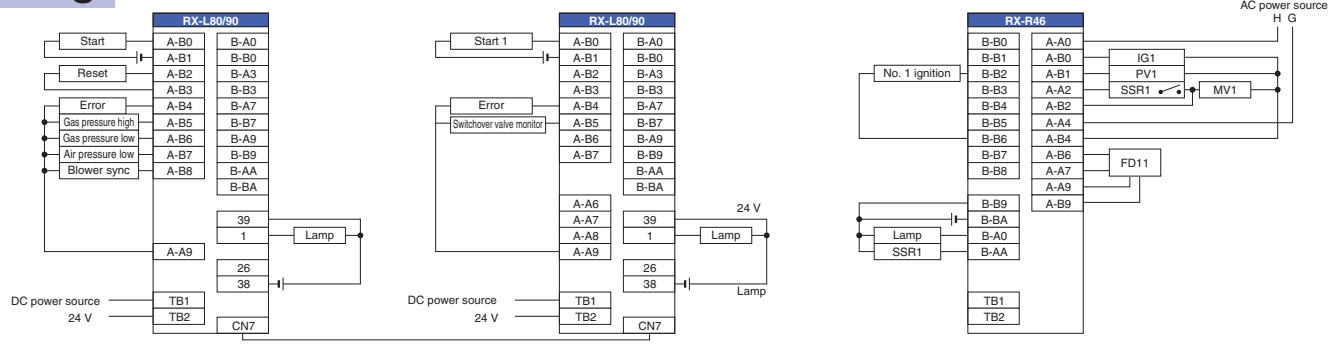


Master valve: Main gas valve
APL: Low air pressure switch
GPL: Low gas pressure switch
GPH: High gas pressure switch
FD11/21: Pilot burner flame detector
FD12/22: Main burner flame detector
IG: Ignition transformer
PV: Pilot safety shutoff valve
MV: Main safety shutoff valve

RX configuration

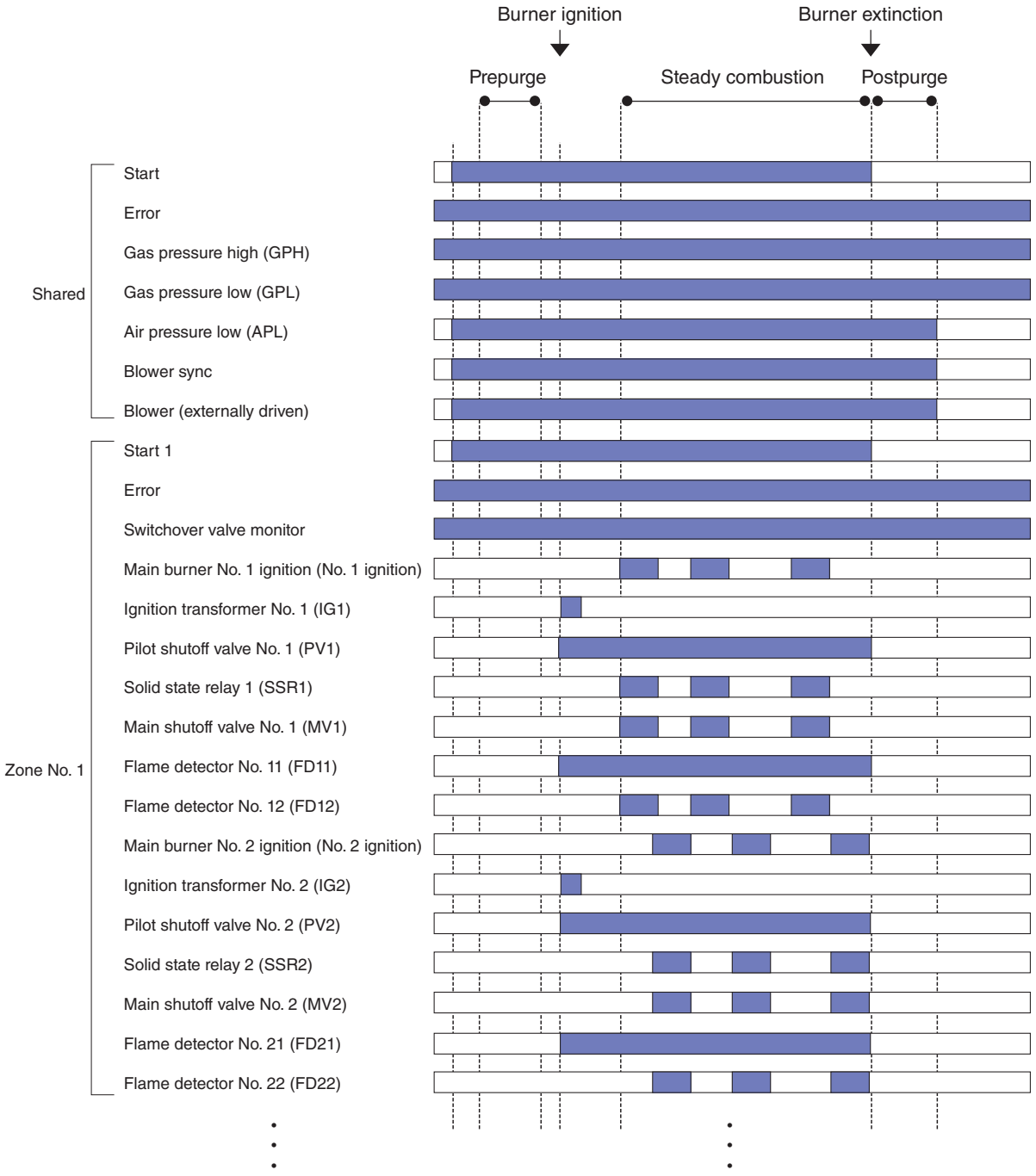


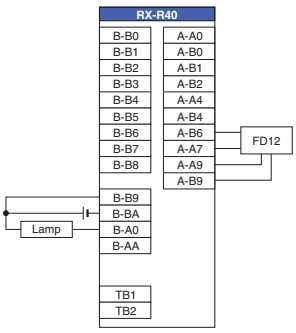
Wiring

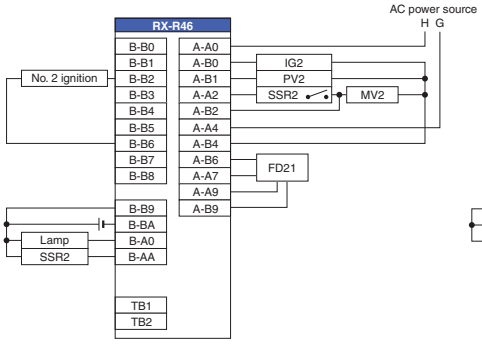


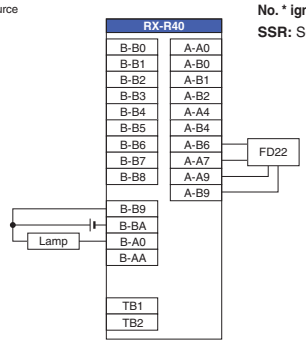
Please refer to pages 68 and 69 for the settings table.

Sequence chart







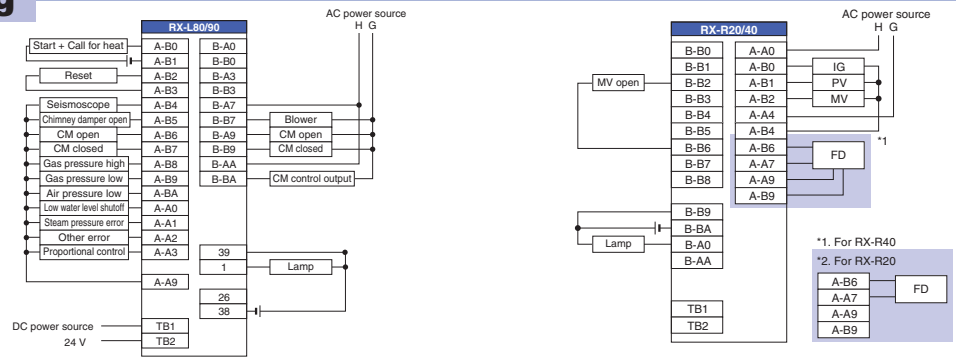


No. * ignition: Ignition of main burner No. "*"
SSR: Solid state relay

Settings Tables

●Single burner 1: interrupted pilot – Proportional control (Boiler)

Wiring



Settings table

●**RX-L**

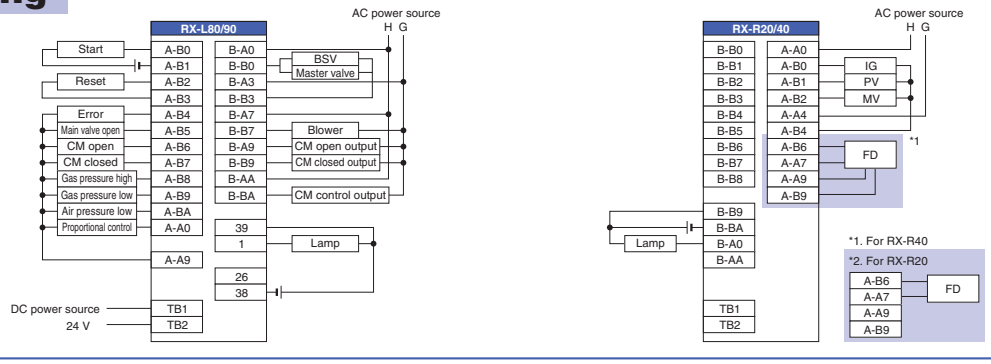
A-1	Shared/zone	Single zone
A-2	Air switch check use	Enabled
A-3	Startup type:	Linked 1
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Enabled
B-5	Control motor output	Enabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	IN3
B-10	Light fire position input	IN4
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●**RX-R**

1-1	Switch combustion mode	Interrupted pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

●Single burner 2: Interrupted pilot – Proportional control (Deodorizing furnace)

Wiring



Settings table

●**RX-L**

A-1	RX-L type	Single zone
A-2	Air switch check use	Enabled
A-3	Startup type:	Linked 1
A-4	760 °C mode use	Disabled
A-5	Air switch check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Enabled
B-3	Relay output	Enabled
B-4	Blower output	Enabled
B-5	Damper output	Enabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	IN3
B-10	Light fire position input	IN4
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●**RX-R**

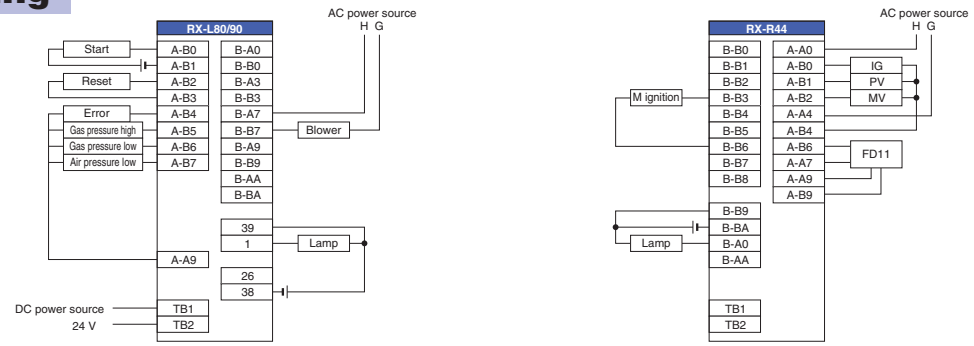
1-1	Switch combustion mode	Interrupted pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	20.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

Memo

Settings Tables

●Single burner 3: Continuous pilot ON/OFF control (Small holding furnace)

Wiring



Settings table

●RX-L

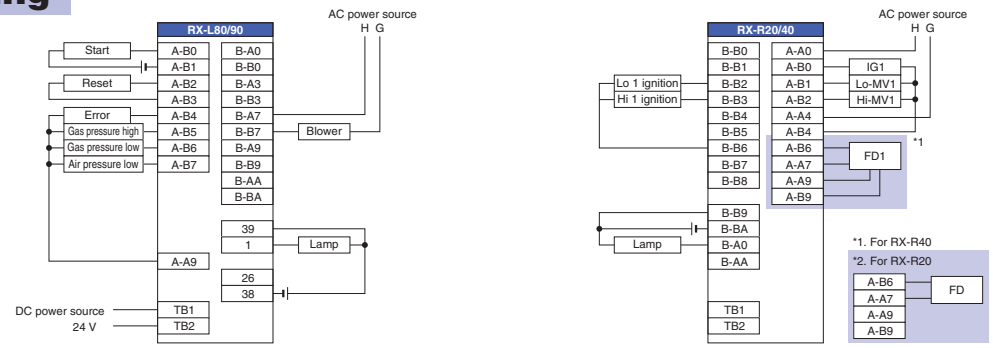
A-1	Shared/zone	Single zone
A-2	Air switch check use	Enabled
A-3	Startup type:	Linked 2
A-4	760°C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Enabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●RX-R

1-1	Switch combustion mode	Individual monitoring
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

●Multi-burner 1: Asynchronous ignition, Interrupted pilot – Hi-Lo-Off Control (Small melting holding furnace)

Wiring



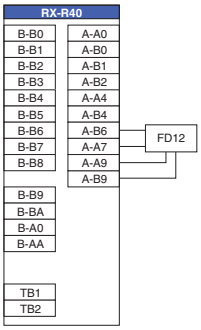
Settings table

●RX-L

A-1	Shared/zone	Single zone
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Enabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●RX-R

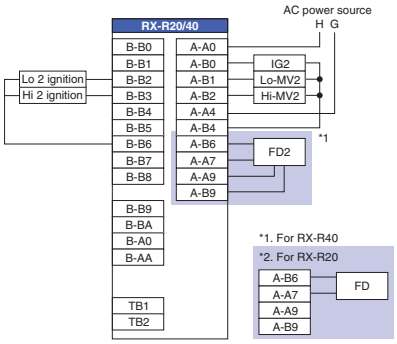
1-1	Switch combustion mode	Continuous pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1



M ignition: Main burner ignition

●**RX-R**

1-1	Switch combustion mode	Flame relay
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	20.0
4-1	RX-R device address	2



Lo * ignition: Low fire ignition of burner No. "*"
Hi * ignition: High fire ignition of burner No. "*"

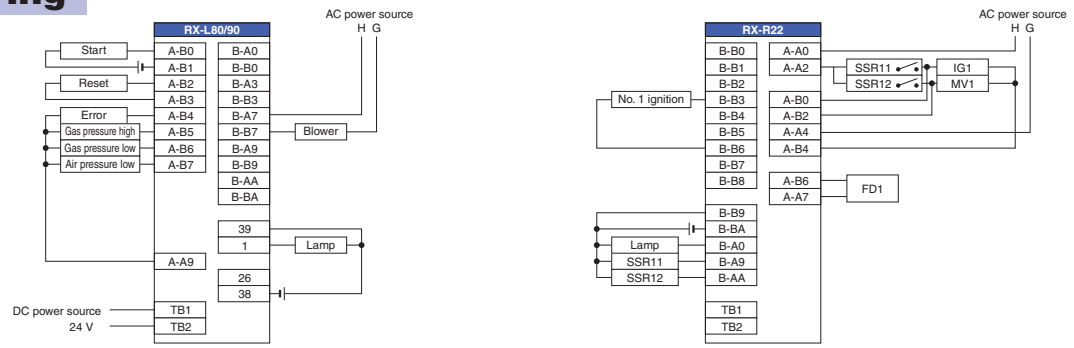
●**RX-R**

1-1	Switch combustion mode	Continuous pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	2

Settings Tables

●Multi-burner 2: Asynchronous ignition, Direct ignition – ON/OFF (Time proportional) control (Large melting furnace)

Wiring



Settings table

●RX-L

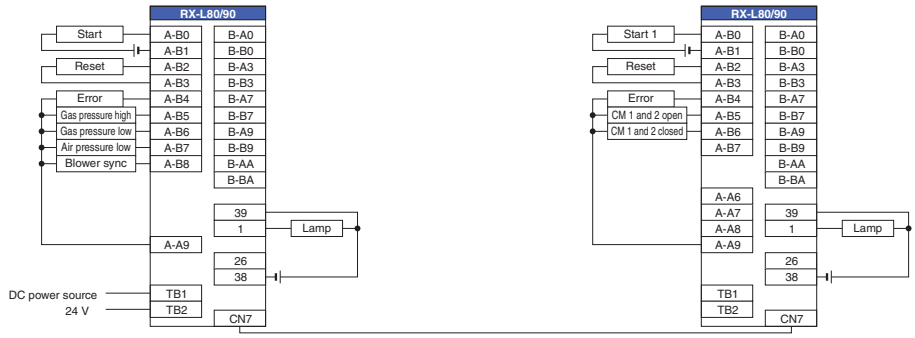
A-1	Shared/zone	Single zone
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Enabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Low fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Cancellation within the allotted time
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●RX-R

1-1	Switch combustion mode	Direct
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

●Multi-burner 3: Asynchronous ignition, Interrupted pilot – Proportional control (Heating furnace 1)

Wiring



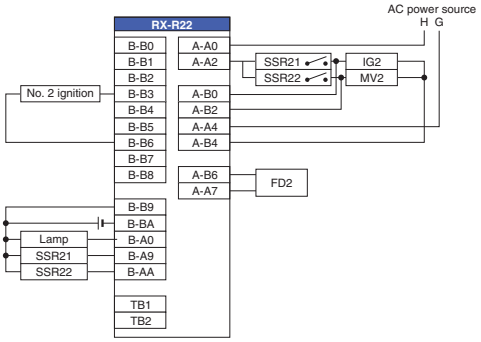
Settings table

●RX-L

A-1	Shared/zone	Shared
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	Blower sync OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Input
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Low fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disab
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	None
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●RX-L

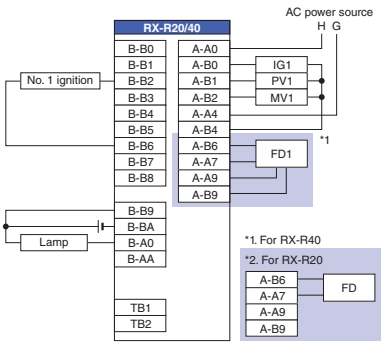
A-1	Shared/zone	Zone
A-2	Air switch check use	Disabled
A-3	Startup type:	Linked 2
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	IN2
B-10	Low fire position input	IN3
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	1

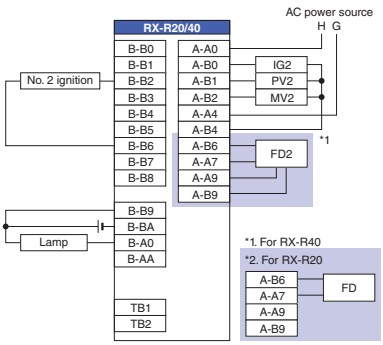


No. * ignition: Ignition of burner No. "*"
SSR: Solid state relay

●**RX-R**

1-1	Switch combustion mode	Direct
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	2





No. * ignition: Ignition of main burner No. "*"

●**RX-R**

1-1	Switch combustion mode	Interrupted pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

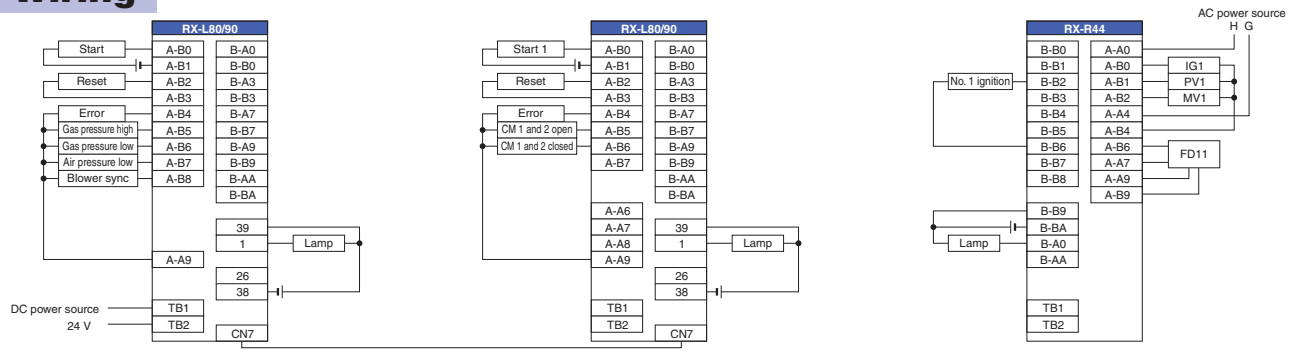
●**RX-R**

1-1	Switch combustion mode	Interrupted pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	2

Settings Tables

●Multi-burner 4: Asynchronous ignition, Continuous pilot – Proportional control (Heating furnace 2)

Wiring



Settings table

●RX-L

A-1	Shared/zone	Shared
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	Blower sync OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Input
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	None
B-16	RX-R prepurge us	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●RX-L

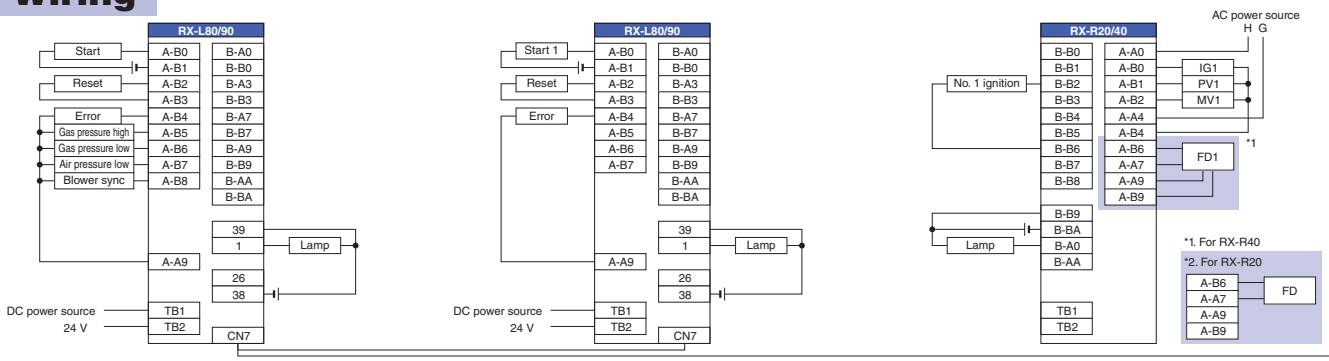
A-1	Shared/zone	Zone
A-2	Air switch check use	Disabled
A-3	Startup type:	Linked 2
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	IN2
B-10	Light fire position input	IN3
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	1

●RX-R

1-1	Switch combustion mode	Individual
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9 ±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

●Multi-burner 5: Asynchronous ignition, Continuous pilot – ON/OFF (Time proportional) control (Heating Furnace 3)

Wiring



Settings table

●RX-L

A-1	Shared/zone	Shared
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	Blower sync OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Input
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	2
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	2
B-15	Postpurge for residual flame	None
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

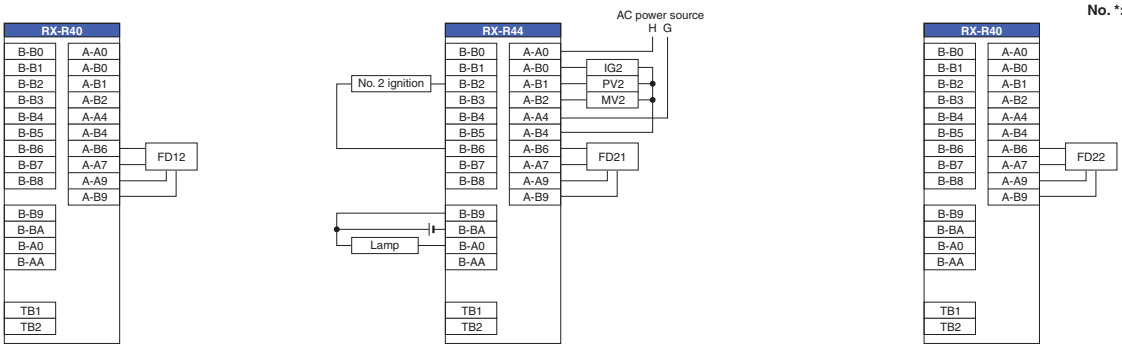
●RX-L

A-1	Shared/zone	Single zone
A-2	Air switch check use	Disabled
A-3	Startup type:	Linked 2
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	1

●RX-R

1-1	Switch combustion mode	Continuous pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9 ±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

No. *: Ignition of main burner No. "*"



●**RX-R**

1-1	Switch combustion mode	Flame relay
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	20.0
4-1	RX-R device address	2

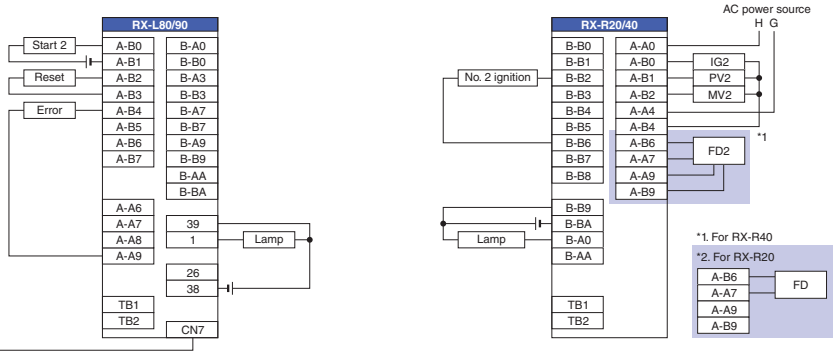
●**RX-R**

1-1	Switch combustion mode	Individual
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9 ±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	3

●**RX-R**

1-1	Switch combustion mode	Flame relay
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5 ±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	20.0
4-1	RX-R device address	4

No. *: Ignition of main burner No. "*"



●**RX-L**

A-1	Shared/zone	Zone
A-2	Air switch check use	Disable
A-3	Startup type:	Linked 2
A-4	760 °C mode use	Disable
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	Lockout
B-15	Postpurge for residual flame	1
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	2

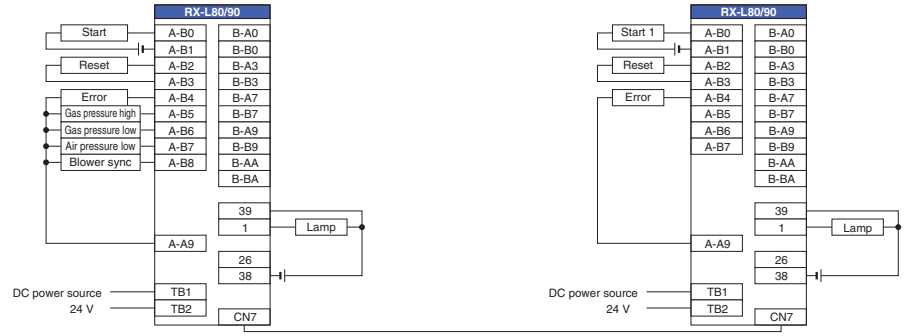
●**RX-R**

1-1	Switch combustion mode	Continuous pilot
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

Settings Tables

●Multi-burner 6: Asynchronous ignition, Direct ignition – ON/OFF (Time proportional) control (Heating furnace 4)

Wiring



Settings table

●RX-L

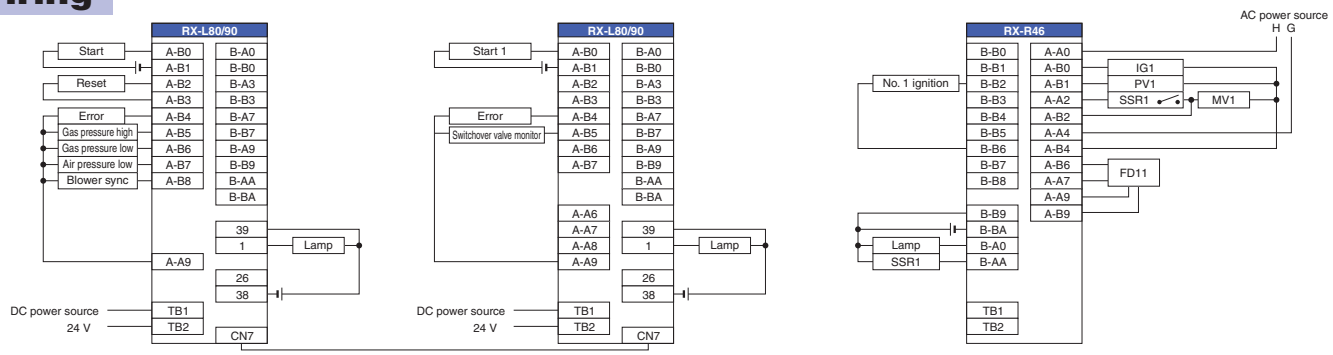
A-1	Shared/zone	Shared
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	Blower sync OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Input
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	None
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

●RX-L

A-1	Shared/zone	Zone
A-2	Air switch check use	Disabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	1

●Multi-burner 7: Asynchronous ignition, Continuous pilot – ON/OFF (Time proportional) control (Heating furnace/ regenerative burner)

Wiring



Settings table

●RX-L

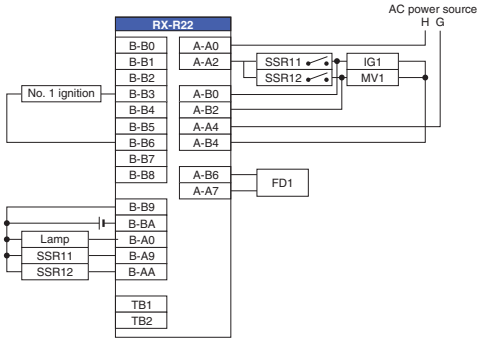
A-1	Shared/zone	Shared
A-2	Air switch check use	Enabled
A-3	Startup type:	Individual
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	Blower sync OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Input
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	None
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	0

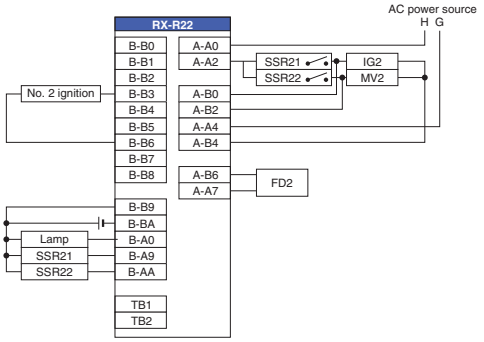
●RX-L

A-1	Shared/zone	Zone
A-2	Air switch check use	Disabled
A-3	Startup type:	Linked 2
A-4	760 °C mode use	Disabled
A-5	Air switch start check result clear	When RX-L start switch OFF
B-1	RX-L start method	Start switch input
B-2	Prepurge use	Prepurge and postpurge enabled
B-3	Relay output	Disabled
B-4	Blower output	Disabled
B-5	Control motor output	Disabled
B-6	Blower sync signal source	Internal
B-7	Purge count start signal source	Internal
B-8	Number of locked-out RX-Ls	1
B-9	High fire position input	None
B-10	Light fire position input	None
B-11	Process timeout handling	Lockout
B-12	Prepurge after RX-R restart	Enabled
B-13	Low fire stop	Disabled
B-14	RX-L connectable units	1
B-15	Postpurge for residual flame	Lockout
B-16	RX-R prepurge use	Disabled
B-17	(Not used)	–
B-18	RX-L communication error handling	Lockout
B-19	RX-L device address	1

●RX-R

1-1	Switch combustion mode	Individual
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1





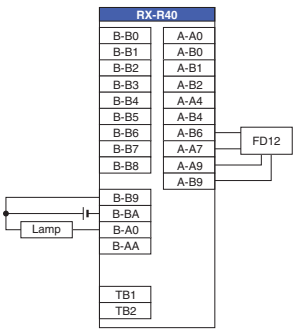
No. * ignition: Ignition of main burner No. "*"
SSR: Solid state relay

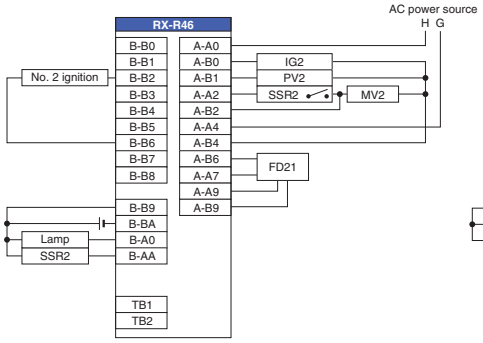
RX-R

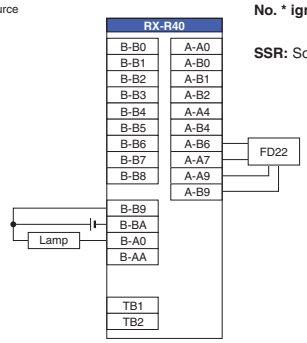
1-1	Switch combustion mode	Direct
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	1

●**RX-R**

1-1	Switch combustion mode	Direct
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	2







No. * ignition: Ignition of main burner No. "*"
SSR: Solid state relay

●**RX-R**

1-1	Switch combustion mode	Flame relay
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	20.0
4-1	RX-R device address	2

●**RX-R**

1-1	Switch combustion mode	Individual
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	9±1 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	0.0
4-1	RX-R device address	3

●**RX-R**

1-1	Switch combustion mode	Flame relay
1-2	RX-R prepurge use	Disabled
1-3	Pilot ignition time	4.5±0.5 s
1-4	(Not used)	–
2-1	Start conditions	RX-L linked
2-2	Reset conditions	RX-L linked
2-3	Restore error wait time	0.0
2-4	Startup delay time	0.0
2-5	Control air valve OFF delay time	0.0
2-6	Air OFF confirmation timeout time	20.0
4-1	RX-R device address	4

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